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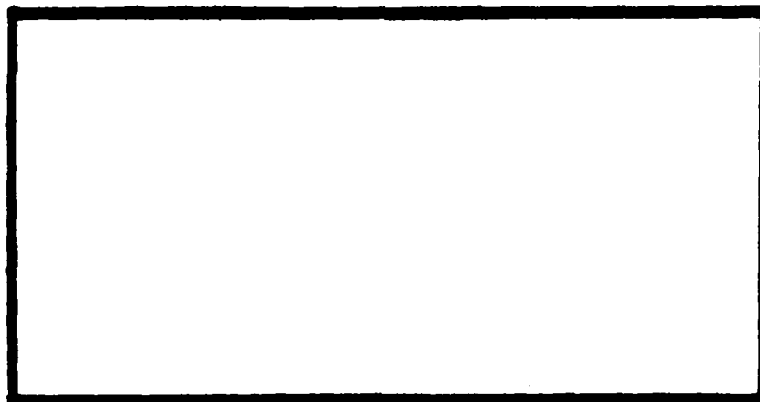
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**Wright-Patterson Air Force Base, Ohio**

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AERIAL PORT OF EMBARKATION
CAPABILITY PLANNING
VOLUME I

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LSSR 62-83

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER LSSR 62-83	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) AERIAL PORT OF EMBARKATION CAPABILITY PLANNING VOLUME I		5. TYPE OF REPORT & PERIOD COVERED Master's Thesis
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Thomas W. Christensen, Major, USAF Gerald L. White, Captain, USAF		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS School of Systems and Logistics Air Force Institute of Technology, WPAFB OH		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS Department of Communication AFIT/LSH, WPAFB OH 45433		12. REPORT DATE September 1983
		13. NUMBER OF PAGES 225
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED
		15a. DECLASSIFICATION. DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Computer Applications   Planning
Computerized Simulation   Reception
Mobilization
Mobility
Models

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Thesis Chairman: Larry W. Emmelhainz, Captain, USAF

The complex nature of the base reception process, combined with the variability of processing requirements, arrival times, and departure times, make planning for the mobilization and deployment of U.S. forces difficult to accurately accomplish. This thesis developed a management tool applicable to all APOE bases to create and evaluate reception plans. The computerized model was fully validated and then used to determine adequate resource levels to achieve on-time preparation of deploying assets. The simulation results were analyzed statistically to ensure resource optimization. Actual warplan data were used in Volume II to generate resource levels required to support the OPLAN.

AERIAL PORT OF EMBARKATION

CAPABILITY PLANNING

VOLUME I

A Thesis

Presented to the Faculty of the School of Systems and Logistics

of the Air Force Institute of Technology

Air University

In Partial Fulfillment of the Requirements for the

Degree of Master of Science in Logistics Management

By

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September 1983

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ulty of the School of Systems and Logistics in partial ful-
fillment of the requirements for the degree of

        MASTER OF SCIENCE IN LOGISTICS MANAGMENT

DATE: 28 September 1983

                        COMMITTEE CHAIRMAN

ACKNOWLEDGEMENTS

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CHAPTER 1

BACKGROUND

World crisis is a common occurance in the political arena of today. Recent conflicts in Lebanon, El Salvador, Poland, and Afghanistan have all upset the stability of international relations. In the environment of flaring national tempers, world economic strife, and territorial greed, the United States military must maintain a constant readiness to preserve U.S. national interests anywhere in the world. U.S. Military response to an international situation may vary from the deterrence provided by our force capability to full mobilization and deployment of those forces. When called upon to mobilize, the Air Force will be one of the primary agencies charged not only with deploying its own combat forces but also with moving the other services' personnel and equipment to the crisis area. Extensive planning goes into our ability to move huge amounts of resources to any location in the world. Despite the detailed nature of those plans, changing conditions always threaten their effectiveness.

The military services have developed warplans as a preliminary estimate of force requirements for various world contingencies. These plans identify required cargo

and personnel along with projected movement tables. In the event of warplan execution an installation serving as an Aerial Port of Embarkation (APOE) must receive and process these resources and accomplish many divergent time phased activities.

The APOE will deploy units permanently assigned to the base as well as receive and deploy units of all services mobilized elsewhere in their geographic area. Certain APOEs located at Air Logistic Centers (ALCs) serving as aerial ports of resupply will also handle a large volume of unit related and non-unit related cargo moving in relation to the deployment. AFR 28-4, USAF Mobility Planning, specifies how base reception plans will be developed (18:A-1); however, planners interpret this to apply only to overseas locations (10). As the result of an Air Force audit which criticized the lack of guidance for CONUS base reception (21), Headquarters USAF/XOORB is revising AFR 28-4 and requiring CONUS APOE bases as well as overseas locations to develop reception plans (6).

The preparation of a realistic APOE reception plan requires familiarity with warplan development and APOE mobility procedures. Development of a warplan is an encompassing process supported at all levels of the DoD structure and results in an extensive data base. Mobility preparation of cargo and personnel for deployment, a labor

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intensive process, requires close coordination among many
diverse and separate activities to ensure on-schedule
departures. The base reception plan which coordinates
these activities must integrate the warplan data base with
mobility activities to ensure adequate base support for
any specific warplan.

Warplan development (Appendix B) describes the forces
and material that will be required to meet a particular
contingency. The planning process further defines speci-
fic units to be deployed, amounts of cargo required, the
routing to be used, and the timing for each group to be
moved to the crisis area. This information is summarized
in the Time Phased Force Deployment Data (TPFDD) report
and is crucial to APOE planners in determining workloads
for the base reception system. The TPFDD data are the
inputs to the APOE base reception system. These inputs
will be processed through the reception system enroute to
the crisis destination to meet the contingency require-
ments of the plan being executed. Effective reception
planning is mandatory to ensure the rapid, on-time proces-
sing of personnel and cargo being deployed as a result of
a national emergency.

BASE RECEPTION

Despite the critical nature of APOE base reception,
this process has not been defined or standardized by

Headquarters USAF. One definition of the reception process limits activites to providing food, shelter, and other necessities to units and individuals arriving from off-base; and receiving, sorting, and preparing off-base unit related cargo for loading. Mobility processing of on-base unit related and non-unit related cargo or personnel, and all Air Cargo Terminal activities are explicitly excluded (10).

For this thesis, however, the reception process will include all support activities, including base mobility, associated with deploying cargo and personnel identified in the operation plan (OPLAN) movement tables. This more inclusive definition represents the total work load created by the OPLAN, and allows planners to identify work centers which may be simultaneously tasked by different sources.

The APOE will process many categories of personnel and cargo arriving from a multitude of sources and requiring specialized services. Deploying cargo and personnel, for example, will originate from both on and off-base locations and will be either unit related or non-unit related. In addition, retrograde cargo and personnel, which includes damaged equipment returning to depots for repair and evacuated non-combatants, must all be processed by the APOE. The base reception process can be best understood by viewing the categories of inputs that require

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processing by the reception operation.

On-base unit related cargo and personnel will receive
mobility processing by their unit. Once this is done,
cargo will proceed directly to the marshalling area and
personnel will return to their quarters until departure.
The majority of non-unit related cargo originates from the
ALC warehousing system or the ALC maintenance facilities.
The Combat Logistics Support Squadron at the ALC prepares
these items for shipment and delivers them directly to the
APOE Air Cargo Terminal (3:4) where they are palletized
for air shipment.

Off-base unit related and non-unit related cargo and
personnel generally undergo mobility processing at their
home station, and do not report to the APOE until shortly
before their departure time. Off-base cargo and passen-
gers may arrive by commercial surface transport or by
LOGAIR. The cargo may or may not have been prepared for
airlift. Upon arrival the APOE must validate mobility
processing and cargo preparation to detect errors or omis-
sions and direct the cargo or personnel to the appropriate
processing area. Additionally, the APOE must supply food
and shelter for these personnel as they await departure
transportation (11).

Retrograde cargo and personnel will be returning to
the APOE from the theater. Repairable spares must be
sorted and routed to the appropriate repair facilities.

Wounded personnel will require special attention, such as medical care at the APOE or transfer to an air evacuation aircraft. Aircraft returning to the APOE directly from the theater will also contain full loads of non-combatant military dependents and U.S. citizens fleeing the hostilities. The APOE must coordinate transportation to commercial terminals and provide food and shelter as required for these people (10). For some APOEs this could create excessive workloads simultaneously with maximum deployment demands.

Mobility processing is accomplished by parent units for unit assets or by the APOE for non-unit assets; both must be checked during the APOE reception. The APOE units must mobility process all on-base cargo and personnel as well as ensure all off-base cargo and personnel were properly processed. Mobility processing is achieved through a time-phased schedule defined by the Mobility Control Center (MCC), reflecting the best estimates of the time required to accomplish mobility tasks. The essential steps in the mobility process include manifesting, selecting and preparing loads, marshalling cargo, processing, and assembling personnel and cargo at unit assembly areas, and loading aircraft (18:p.3-1). Some of these steps will be accomplished prior to entry into the base reception system; others will not.

Mobility work centers will accomplish the time-phased

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actions reflected in the mobility schedule spontaneously rather than by direction of the MCC. Generally each work center accomplishes a primary task. For example, load planners coordinate load build-up with the air cargo terminal and the passenger terminal. A controller monitors mobility activities and reports problems to the MCC. Quality control personnel audit cargo and passenger manifests before the scheduled aircraft load time. The Ramp Coordinator monitors cargo marshalling and aircraft loading operations. The Air Cargo Terminal function receives and inspects cargo at the cargo marshalling area and checks for proper preparation and marking, air transportability, and proper documentation. Equipment is then marshalled by load number. The Air Passenger Terminal function provides complete passenger services to prepare and process personnel for deployment. These services include passenger briefings, troop commander briefings, baggage handling, passenger manifesting, anti-hijacking procedures, and passenger loading. The Sub-Motor Pool provides vehicles and drivers to transport deploying personnel to the mobility processing area, material to the marshalling area, and passengers to the aircraft load site (18:p.3-3).

PROBLEM STATEMENT

APOE managers presently have no means to integrate

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OPLAN movement data with reception processing requirements
to determine time-phased workloads for preparation of APOE
reception plans.

JUSTIFICATION

While APOE managers are tasked with planning for and
managing an extremely large, complex, and dynamic system,
many unit level managers do not have the World Wide Mili-
tary Comand and Control System (WWMCCS) Integrated Network
(WIN) capability to access the Joint Operations Planning
System (JOPS) (Appendix B). They also do not have ready
access to MAC or MTMC deployment movement tables. Even
with these movement tables it is nearly impossible to
manually determine workloads for the numerous tasks.
Also, during mobilization the published movement table may
change suddenly. With current capabilities managers have
no way to quickly evaluate the effects of these changes on
their reception system.

The OPLANs are written to deploy only the minimum
essential assets to sustain combat operations during the
initial phases of conflict (20:36), so the APOE must be
prepared to efficiently process all resources identified
on the movement tables. Some APOEs are tasked to deploy
such a large number of units from different commands
simultaneously, that requirements may exceed the capabil-
ity of the installation to receive supporting aircraft, or

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process and load personnel and equipment to meet departure times. In those instances the mobility work centers should be expanded to accomodate the most demanding OPLAN tasking for that unit (18:p.3-4). Managers know the estimated total resources scheduled through their APOE; however, without the timing of that flow they cannot determine how work centers must be expanded to accomadate OPLAN tasking.

OBJECTIVE

The objective of this thesis is to create a model of the APOE base reception process and validate that model so that it can be used as an effective management tool. The model should be flexible enough to be used at any APOE and capable of evaluating present resource levels as well as generating optimum resource requirements to accomplish base reception.

A previous thesis attempted to model base reception (3). Model development was well documented; however, many assumptions were proposed, and the model was not suffic-iently validated. Also, that thesis did not tie the simulation into an existing data base to provide actual information.

This thesis uses this existing reception model as a departure point. Our efforts will concentrate on model accuracy, and building confidence in the simulation

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results through substantiating assumptions and model
validation. We will establish a means to transfer data
from the TPFDD to a computer system with simulation lan-
guage software. Finally, we will use actual movement data
to generate workload information to demonstrate model
usefulness.

RESEARCH QUESTIONS

To model base reception four key questions must be
resolved:

1. What are the critical factors representing the
   reception process?

2. What are the duration distributions associated
   with reception activities?

In order for simulation results to be accepted and
implemented the model must be thoroughly validated. Yet,
wartime simulations possess inherent validation difficul-
ties in that the simulation cannot be compared with exist-
ing real world peacetime operations.

3. What technique will best validate the reception
   model?

The final objective of modeling and computer simula-
tion should assist managers in their decision process. The
computer output should clearly demonstrate this attribute.

4. Does the simulation clearly identify critical
   shortfalls?

SCOPE

This thesis will provide managers a means to develop
alternative reception plans for APOE mobility/deployment
OPLAN taskings or evaluate present plans using the exist-
ing data base. A computer simulation model of the recep-
tion process will generate two types of information.
First, it will determine expected demands for a specific
OPLAN, allowing for the APOE manager to determine work
center adequacy. This information allows for reception
planning and justification for work center expansion as
required by AFR 28-4 (18:p.3-4). Second, upon OPLAN
execution, the simulation can be run with actual work
center facilities and expected inputs to anticipate
shortfalls. Managers can then take corrective action
prior to the actual development of a critical shortfall.

This model should be generic to the extent that it
will apply to any APOE. To narrow the range of assump-
tions and to facilitate validation, modeling data will be
collected at Wright-Patterson AFB. The structure of
Wright-Patterson's reception process is similiar to other
APOEs (10), so this model should apply to any APOE with a
minimal change of parameters within the model.

CHAPTER SUMMARY

APOE base reception is a critical, but neglected
factor in the mobilization and deployment of U.S. forces.
The complex nature of the reception process, combined with
the variability of processing requirements, arrival times,
and departure times make planning for this system diffi-
cult to accurately accomplish. Because of its vital
importance to military readiness, APOE managers need an
effective management tool to create and evaluate reception
plans. The goal of this thesis is to develop that tool,
prove its accuracy, and demonstrate its usefulness as a
valuable aid in the planning process.

CHAPTER 2

METHODOLOGY

In order to provide a useful tool for managers to
successfully meet the requirements of planning a full scale
mobilization, a system of very complex components and
relationships must be understood and evaluated.   The problem
of precisely describing such a complex operation calls for a
systems analysis approach (14:6).   This analysis provides a
better understanding of the system's operating characteris-
tics.   To evaluate the reception system's capabilities and
operation exactly (eg. actually mobilize our forces) would
be very expensive and impractical given the ramifications of
full mobilization in today's political environment.   The
analyst must pursue a more reasonable method for under-
standing this complex system.

SYSTEM ANALYSIS

The Rand Corporation (4:6) classifies a spectrum of
systems analysis methods ranging from the least to most
abstract as follows:

    1.   Real World
    2.   Observations from the real world
    3.   One to one simulation
    4.   Game simulation

5. All computer simulation
6. Mathematical analysis.

The "observation" level depends on real world environmental factors to validate the observations. While the U.S. military services do perform mobility exercises, they are never executed in the crisis environment when all military activity would be focused on the mobilization. In fact normal operations often supersede mobility exercise operations, thus limiting exercise realism.

One to one and game simulations were developed largely for training situations and focus on the trainees and their decisions rather than on the system. Our interest is in an accurate understanding of the system's characteristics and operations. Perhaps after a validated and verified system model is developed, game simulation could be accomplished by varying the decision rules. This would provide sensitivity data on certain decisions, but, is only possible <u>after</u> a validated system model is achieved.

Mathematical analysis, the most abstract method, is more applicable to the physical sciences. In our case the statistical decision theory or linear programing approach:

1. Oversimplifies the complex goals of a large system,
2. Requires mathematically precise rules which have not been discovered,
3. Requires impossible-to-obtain information, considering the degree of abstraction [4:7].

Drawbacks and real world limitations of these anal-

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ysis techniques of the Rand spectrum point to the all

computer simulation approach as the most suitable method

for our purpose.

COMPUTER SIMULATION

Computer simulation is the most important and useful

tool in analyzing the capability and operation of complex

systems (13:1). This method is highly abstract, but still

provides ample flexibility for our purpose. Several

advantages are present:

1. The component to be optimized need not be

specified. In fact, the simulation will identify critical

factors.

2. Detail and complexity need not be sacrificed to

arrive at a conclusion.

3. Random behavior and time considerations can

readily be incorporated into the model.

The major drawback to this method is the requirement

to specify all relationships between activities and

resources, that is, to provide a decision rule for any

situation (ie. represent the human decision maker). While

expert advice and experience are excellent guides in this

area, it is still recognized as a limitation and sensitiv-

ity analysis must be performed on decision variables to

account for the human factor where such considerations are

required.

While the use of simulation appeals to managers
because of its apparent simplicity and face validity,
several inherent shortcomings must be considered. The
expense in dollars and man-hours to develop and compu-
terize a simulation model must be weighed against the
perceived benefits. Verification, validation, and sensi-
tivity analysis of the model are always required, because
models are prone to inaccuracy, high sensitivity, and
unrealistic representation of the real system (13:13).
Assumptions should be scrutinized and questioned, as well
as techniques for verification, validation, and sensitiv-
ity analysis. Sometimes these shortcomings must be
accepted, because simulation can provide answers to
questions not attainable by other means (eg. war scenar-
ios) (13:12). This study deals with a situation not
readily verifiable in the real world, and some of these
shortcomings are present. More detailed analysis of these
limitations is presented in later chapters.

PROBLEM SOLVING PARADIGM

Robert E. Shannon provides an excellent structure or
problem solving paradigm for our computer simulation
systems analysis.

> 1.   System Definition--Determine the boundries,
> restrictions and measure of effectiveness to be used
> in defining the system to be studied.
> 2. Model Formulation--Reduction or abstraction

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of the real system to a logic flow diagram.

     3. Data Preparation--Identification of the data
needed by the model, and their reduction to an
appropriate form.

     4. Model Translation--Description of the model
in a language acceptable to the computer to be used.

     5. Validation--Increasing to an acceptable level
the confidence that an inference drawn from the model
about the real system will be correct.

     6. Strategic Planning--Design of an experiment
that will yield the desired information.

     7. Tactical Planning--Determination of how each
of the test runs specified in the experimental design
is to be executed.

     8. Experimentation--Execution of the simulation
to generate the desired data and to perform
sensitivity analysis.

     9. Interpretation--Drawing inferences from the
data generated by the simulation.

     10. Implementation--Putting the model/or results
to use [13:23].

Complete, accurate execution of each of these steps
will produce a simulation model that is easy to under-
stand, achieves its purpose, provides reasonable answers,
includes all relevant factors, and provides managers with
a reliable tool to use in planning APOE base reception
activities. The following activities are general guide-
lines for the accomplishment of each step. Readers
familiar with this paradigm may procede to Chapter 3
without loss of continuity.

SYSTEM DEFINITION

This initial step establishes boundries, restric-
tions, and measures of effectiveness. Every system is a
subsystem or element of a larger system, so in order to
establish these factors we must establish an analytical

approach to define our system. We will use the General

Systems Theory systems analysis approach and definition to

identify our system. This approach defines a system as

> a set of objects together with relationships between
> the objects and between their attributes connected or
> related to each other and to their environment in
> such a manner as to form an entirety or whole
> [14:12].

To define our system consistent with this definition we

must first identify the system objects along with their

attributes, and relationships. These objects form a goal

seeking entity distinctly separate from their environment,

yet dependent upon interactions with the environment

(13:25;12:1).

Open systems receive resources from the environment

as inputs and perform transformations to create outputs.

A complete system definition must determine essential

environmental resources, and the desired system outputs.

All systems must be goal oriented in order to integrate

various system elements toward desired outputs. The

degree of goal achievement determines system effectiveness

and efficiency (13:26).

With these concepts the boundary separating the system

from the environment can be determined. Elements and

relationships within the boundary are considered control-

lable by the system while elements outside the boundary

represent environmental factors and may influence the

system but are not directly controllable by the system.

The initial modeling effort should concentrate on the controllable system elements and relationships (13:27).

MODEL FORMULATION

The simulation effort implies a perceived problem in system operation. The modeler's first task must center around an accurate and concise formulation of the perceived problem. An accurate statement of the problem begins with desired goals. These goals bound the system by identifying desired outputs, thus defining relevant elements and inputs. Problem formulation should concentrate on examining all these bounded elements to determine their attributes and relationships. This examination should identify the critical attributes and relationships. This represents the most important step in model definition for it allows the modeler to eliminate insignificant elements and relationships. Often simply identifying the critical components will identify the causes of the problem. If further analysis is required, it can concentrate on critical components for model formulation (13:27,12:11).

Once the modeler has defined and limited the system to critical components he must acquire a thorough understanding of how the system is supposed to operate, as well as how it actually operates. In this stage he must observe, participate, interview, and examine documentation,

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always questioning the validity of the facts (13:45). The

progressive development of a graphical representation of

the system may facilitate this process and begins the

actual model development (13:46).

With increased understanding of the system and the

formulation of a structural model, the modeler must incor-

porate all relevant variables. Variables can be divided

into four groups. Endogenous variables represent factors

within the system and which are under system control.

Exogenous variables are necessary inputs from the environ-

ment. They have direct influence on the system but cannot

be directly controlled. Status variables change with

system operation; therefore, they represent the current

state of the system. Finally, the criterion variable

represents the system objective or goal. It is the final

measure to determine system effectiveness (13:15-16).

The structural model along with all variables repre-

sents the working model for development of the simula-

tion. A model flowchart should be prepared at this

stage. The flowchart has the advantage of a graphical

representation of component relationships along with

relevant variables. The flowchart also prepares the model

for the computerization step (13:151).

The modeler must be aware that the structural model

is never complete and final. As he continues his system

investigation and data collection new relationships and

variables will become apparent (12:11-12). The intial
working model should be simplified to include only the
relevant critical components and modified as system defi-
nition dictates (13:26).

DATA PREPARATION

The model formulation identified four types of
variables important in the model. Endogenous and cri-
terion variables are internal to the system and can be
specified for the simulation. Status variables result
from system operation. Exogenous variables represent a
problem in that their values must be estimated or gener-
ated, and then input into the simulation. This process is
a critical step in the system's analysis as it lays the
foundation for further model evaluation (13:28).

There are several methods to generate exogenous
variables. These values may be hypothesized based on the
initial system analysis and model formulation and then
reviewed by individuals familiar with system operations to
substantiate variable value validity. A second method
involves reviewing system records for required data. This
method is dependent on availability of accurate records
containing the required information. A final technique
requires actual field collection of the data. This tech-
nique is most expensive and time consuming but results in
the most accurate estimation of the exogenous variables

(13:28;12:43-44).

Once the exogenous variable data are collected they
can be applied two ways. First, the actual historical
data can be input into the simulation and various endo-
genous variable combinations tested against thes data.
This will indicate the best solution under historical
conditions. A second approach requires analysis of the
historical data to determine representative distribu-
tions. These representative distributions can then
produce new exogenous values representative of the histo-
rical data. This technique allows various endogenous
variables to be tested against possible future events
(13:27-28).

The second technique allows more flexibility;
however, it requires more effort and caution to validate
the inputs. The first step in this process requires
analysis of the historical data. The data should be
plotted on a histogram, fitted to a curve, and statis-
tically analyzed to identify characteristic paramenters. A
representative distribution can then be hypothesized and a
Chi-square Goodness of Fit statistical analysis per-
formed to confirm the hypothesized distribution (12:48).
Once the distribution is confirmed a computer program can
be written which will generate samples conforming to this
distribution. Monte-Carlo sampling will randomly extract
variates from this distribution for input into the simu-

lation (13:65). Before running the Monte-Carlo simulation the distribution should be tested by drawing a variate sample and performing a Chi-square Goodness of Fit or Kolmogorov-Smirnov statistical analysis to confirm the sample represents the original historical distribution (12:48). Depending on the importance of the variable in the simulation other statistical tests for autocorrelation and variate randomness should be performed before accepting the Monte-Carlo variates (13:355-356).

MODEL TRANSLATION

In this step the working model must be translated to a computer language. Many different simulation oriented computer languages have been developed to aid the simulator in computerization. The appropriate language depends on the nature of the model, the purpose of the simulation, and the type of computer (13:28,98,12:12).

Common model orientations include network, event, or structure. Q-Gert and SLAM languages are network orientated (12:445). In these languages the modeler formulates the system as an interconnected network of activities and decision points. Entities or transactions then flow through the network activities and decision points. SIMSCRIPT is primarily an event oriented language (12:451). In this language the model is defined by enti-

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ties, attributes and logical groupings of entities. The language monitors the system's changing structure at specific event times. DYNAMO is an example of a structural language. It was developed by Forrester to analyze complex problems relating to system dynamics. This language monitors non- linear system state or structure variables represented by levels (12:461).

The purpose of the simulation dictates a discrete or continuous computer model. Discrete or continuous refers to the incrementation on the independent variable, "time" within the simulation. Discrete simulation advances time discretely at specified points (12:65). The time advance can be either continuous fixed interval advances, or discrete variable event oriented advances. The dependent variables change only when the time advances. A discrete simulation applies to event oriented problems. GASP, Q-Gert, and SIMSCRIPT are discrete languages. In continuous simulations the dependent variable changes continuously over time. Continuous simulations use partial derivitives to specify system states and originally applied to analog computers for population analysis and for process state analysis. Modern high sperd digital computers and newer languages such as SLAM have developed integration algorithms which allow digital computers to approximate continuous simulations (12:71).

The selection of a language for a simulation is

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dependent on the model, simulation purpose, type of
computer, and software availability. Commonly available
languages in DoD include SIMSCRIPT II, Q-Gert, and SLAM II
(9).

VALIDATION

The validation step increases confidence in the
simulation output. It shows that the simulation
satisfactorily represents the real world, thereby giving
management more confidence to implement the results.

The validation process consists of two steps, veri-
fication and validation. Verification confirms that the
computer model is performing as the original working model
intended. All models can and must be verified. Valida-
tion reviews the concepts, assumptions, and restrictions
of the original working model to affirm they represent the
original system. Validation reflects an inherent weakness
of simulation. Simulation is most directly applicable to
systems which cannot be measured directly. Therefore,
direct measurement of, or experimentation with the actual
system for comparison is impossible (13:30;12:12).

Three commonly accepted techniques for verification
are hand duplication of a computer run, trace statements,
and canned data. Hand duplication is a time consuming
procedure, but it allows the values of each variable to be
calculated to confirm that the logic in the computeriza-

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tion follows the working model logic. This technique is
applicable only to simple simulations. A second technique
places trace statements throughout the computer program to
print out critical variables. This allows the computer to
do the time consuming calculations, and then the variables
can be analyzed to confirm the logic is valid. Finally,
canned inputs with predetermined results can be run to
verify that the computer output agrees with the antici-
pated results. This technique must input data which exer-
cises all subroutines in the program. To do so usually
requires several runs with data representing mean values and
values to each extreme (13:30,12:12-13).

Simulation models cannot be measured directly for
validity so several philosophies have evolved for accept-
able techniques. Rationalists, closely associated with
mathematics and logic, theorize that one must accept
fundamental basic unproven premises from which the rest of
the model can be logically developed. The problem with this
approach is the unquestioned acceptance of the basic
premises (13:212). Empiricists represent the opposite
extreme and will not accept any premise without experi-
mental evidence (13:214). Simulation techniques can be
proven empirically; however, system model formulation or
simulation application cannot be validated experimently.
Pragmatists are not concerned with the actual validity of
the model. Instead, they concentrate on model usefulness

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in a predictive nature. Do inputs accurately predict out-
puts? The problem with this approach is that the model
cannot be evaluated until after implementation to deter-
mine prediction accuracy (13:214).

The final philosophy, the utilitarian approach,
combines the three previous philosophies (13:215). Utili-
tarian validation is a realistic progressive means to
evaluate the working model. First the model is ex-
pressed in mathematically logical terms using fundamental
system knowledge for basic premises. Next the simulation
is experimentally tested within the range of available
limits. Finally, the predictive nature of the model is
demonstrated by comparing the model to the real world
wherever possible. The simulator should combine the three
techniques of model logic, experimentation, and real world
comparisons to convince management that the model repre-
sents the real world (13:215-217). Once managemnt accepts
the model's validity, they should accept the simulation
results and support subsequent implementation.

STRATEGIC PLANNING

Strategic planning pertains to developing the exper-
imental design which will best identify relationships
between the independent variables and the dependent
variable. Experimential design for a simulation is
subject to the same constraints and statistical analysis

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as a true physical scientific experiment. However, simulation allows the experimenter increased control over independent variables and experimental conditions. In simulation the experimenter can reduce spurious experimental variance by testing different treatments under identical conditions to determine the best solution (13:30).

Shannon (13:151) proposes a three step process to experimental design. First, develop the structural model, then identify the functional model, and finally, design the experimental model.

The structural model consists of the desired independent variables and the number of treatment levels for each variable. The objectives of the experiment, measurability of the factors, and nonlinear effects should determine the required factors and levels. The number of different experimental treatments required is exponentially related to the number of factors and levels. In the structural model the experimenter should not limit factors or levels to conform to resource constraints (13:155). The structural model reflects the ideal experiment.

The functional model determines how many of the treatments will actually be measured. A complete functional model measures each treatment thus duplicating the desired structural model, while an incomplete func-

tional model measures only a portion of the treatments.
Usually labor, money, or computer time limits the simula-
tion effort, so an incomplete functional model must be
adopted. To derive the best incomplete functional model
the experimenter should analyze the system and working
model to eliminate logically infeasible treatments. The
functional model reflects the actual practical experiment
(13:155).

The experimental model determines how the experi-
mental results will be statistically analyzed. The exper-
imental design may be concerned with determining the means
and variances of different alternatives, effects of dif-
ferent variables, or optimal values for the variables.
Each purpose of the simulation requires a different type
of statistical analysis and a different experimental ap-
proach. The experimental model will determine the number
of simulation repetitions for each treatment (sample size)
required for significant statistical analysis (12:498).

The strategic planning process determines which
endogenous variables and associated values should be
examined in the simulation. Additionally, the required
statistical tests are identified and appropriate sample
size calculated to obtain statistically significant
results (13:30-31).

TACTICAL PLANNING

Tactical planning investigates the proper experimental data collection procedure to reduce simulation induced variance. Reduction of this variance strengthens the experimental design developed during strategic planning and increases the statistical significance of the independent/dependent variable relationship (13:31).

The majority of simulation induced variance results from start up transients (13:181). Generally the simulated system is an ongoing steady state process with inputs at various stages of processing. The simulation cannot start in a steady state, so the initial data will be erroneous when compared to the real world. Running the simulation for a long enough period to cause the intial data to be insignificant compared to the steady state data reduces start up variance; however, this solution is often prohibitive due to excessive requirements for computer time (13:181). A second solution discards the initial data and analyzes only the steady state data. This solution must determine when the simulation reaches steady state in order to begin data collection (13:181). One common technique calculates a moving average of the simulation data. When the third order moving average changes less than 2% equilibrium can be assumed (2).

Most statistical testing of simulation results assumes independent and uncorrelated samples (13:187).

This may be a faulty assumption because simulation often produces autocorrelated data. Autocorrelated data implies the previous results influence the present or future results. If the simulation data is collected through time the output should be analyzed for autocorrelation. If autocorrelation exists the experimenter has several options. He can determine the factor causing the autocorrelation and include it in the functional model as a factor; or, he can take a larger sample size to reduce the significance of the autocorrelation. Finally, he can randomly introduce dead spaces in the simulatior where no data is collected to reduce autocorrelation. The larger sample or simulation dead space will increase computer time and must be considered when designing the functional model (2;13:187).

EXPERIMENTATION

In this step the simulation is run and the output data are collected. The data should then be statistically analyzed to determine the factors producing the optimum criterion variable. This optimum answer reflects the assumed and measured distributions introduced as exogenous variable inputs. These experimental inputs may vary from the real world, so before the optimum solution can be positively selected, its sensitivity to exogenous variable inputs must be determined (13:32;12:13).

Sensitivity analysis increases confidence in the simulation results. For this process the exogenous variable distributions and original data collection techniques must be reviewed. If the validity of a distribution is questionable the distribution parameters should be increased or decreased one at a time to determine the effects on the criterion variable. If the optimal solution does not change as the exogenous variables are adjusted, the experimentor can be more confident with the simulation solution (13:32).

INTERPRETATION

By this step the simulation is complete. For nonsensitive optimal solutions, interpretation is simple; management can accept the simulation solution with a relative high degree of confidence.

If the optimal solution changes when the initial experimental data are modified, then the results are sensitive to inputs, eliminating a clearcut optimum solution. For a sensitive solution management must select from the best solutions or revalidate the sensitive input variables to reconfirm the simulation's original optimum solution. For sensitive solutions the difference in cost between the optimal solutions will indicate to management the value of better information to revalidate the exogenous variables (13:31;12:13).

IMPLEMENTATION

In this stage the simulator's responsibility centers around proper documentation and briefings so that management has a thorough understanding of the simulation process. A thorough accomplishment of the previous nine steps should provide a good projection of the real world, allowing management to accept and implement the findings with confidence (13:32-33;12:13).

CHAPTER SUMMARY

Computer simulation is the best method to accomplish the systems analysis of the APOE reception process and provide a tool for evaluation and planning. This approach ensures accurate and flexible representation of the system and can be accomplished using Shannon's ten step problem solving paradigm (12:23). Detailed application of the paradigm to APOE reception follows in Chapter 3.

CHAPTER 3

MODEL APPLICATION

The general aspects of base reception covered in
Chapter 1 were fitted to the problem solving paradigm
described in Chapter 2. The system description was ex-
panded, resulting in a model of APOE base reception. This
model was then further processed through the steps on the
paradigm and resulted in a useful planning and evaluation
tool for APOE reception managers.

Because APOE reception is comprised of similar tasks
at all reception bases, a specific model for the Wright-
Patterson AFB (WPAFB) reception function can be used as a
basis for models of other APOEs (10). The first and most
critical step in developing the WPAFB model and using it
as a planning tool was system definition (13:90).

SYSTEM DEFINITION

During mobilization, reception will be only one of
the many functions being performed at WPAFB. The recep-
tion activities, however, will have priority (7).
Research, experimentation, procurement, and other usual
base functions will have minimal direct impact on the
mobility effort and are not included in this model. Some

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of the reception activities described in Chapter 1 do not directly affect the APOE's ability to mobilize cargo and personnel, so they too are not considered in this model. Other factors, such as retrograde cargo or specific aircraft load planning, have not been estimated by the planning community, so are not included in this model.

The goal of the reception effort is to receive and process cargo and personnel for shipment on-time to the crisis area. Our system is confined to those factors directly relevant to personnel and cargo being received and processed for on-time departures. The initial system boundary is the arrival point where cargo and personnel are received and directed to their next stop within the system. At WPAFB this boundary is the reception gate. The outbound limit of the reception system is either the marshalling area boundary where cargo is loaded onto K-loaders to be put on aircraft, or the passenger terminal where personnel depart the system to be loaded on air- craft. K-loader and passenger loading operations, while potentially of interest to the total war effort, are not considered part of base reception cargo preparation (10).

This system incorporates the reception personnel and resources anticipated to be available. Available resources include resources on hand as well as resources planned to move to WPAFB to assist in reception (eg. augmentation personnel). The system inputs are the personnel and cargo

requiring processing. The outputs are passengers ready to be loaded on aircraft, and cargo properly palletized for air shipment and ready to load on aircraft.

The restrictions on our system are imposed by TPFDD requirements, operating policy/regulations, and safety regulations. The local politics concerning where to locate certain functions (passenger terminal, marshalling area, explosive cargo area, etc.) can also impose restrictions (7).

A successful reception system prepares an acceptable percentage of cargo and personnel for timely transport (1;7;10). This percentage can be used as a measure of system effectiveness, and its desired value must be set by system managers. This model will aid managers by allowing them to adjust individual controllable variables to eval- uate their effect on the entire system.

MODEL FORMULATION

Within these boundaries and restrictions a more de- tailed description of the reception process at WPAFB was pursued. A graphic model (Appendix C) was created to identify system elements, attributes, and relationships. Only the critical elements were retained in the model. For WPAFB, exogenous variables (outside system control) include the amounts of cargo and personnel arriving, their

arrival times, processing and transportation times, and
the weather. Endogenous variables (within system control)
are the number of people available to process the arri-
vals, the amount of space provided for processing and
storing the arrivals, and the equipment needed to process
the arrivals (forklifts, buses,etc.). Status variables
are the number of people billeted, people waiting for/or
in processing, pallets in the marshalling area, and the
amount of cargo awaiting various processing steps. The
criterion variable (system evaluation) is the percentage
of inputs processed for departure on-time. The relation-
ships of these variables can best be described by consi-
dering the two types of arrivals (personnel or cargo)
separately.

PERSONNEL RECEPTION

Arriving personnel will fall into three categories:
non-deploying augmentees, unit related personnel, and
non-unit related personnel. Arriving personnel are trans-
ported, processed, billeted, and fed in terms of a Force
Requirement Number (FRN). A FRN may be one person or 500
people. Part of a FRN may be transported within the sys-
tem, but, only complete FRN's are processed (briefed,
etc.), and the entire FRN must be processed before it will
depart the sytem.

All personnel will be directed to arrive at gate 26C
for reception (11). At the reception point mobility

personnel will direct the arrivals to their next stop. Augmentee personnel will be directed to non-temporary quarters and from there exit the reception system.

FRNs departing within 18 hours will proceed directly to the passenger staging or holding area (11). Many FRNs will have their own vehicles which they can use for transportation to the staging area. After the personnel are in the staging area the vehicles will be driven to the vehicle processing area and be prepared for air shipment (7). If the deploying FRN does not have its own vehicles, the personnel must await bus transportation and then move in groups of up to 40 to the passenger staging area.

FRNs departing in more than 18 hours will proceed to billeting either by their own transportation or via base bus as described above. Billeting may be assigned in VOQ facilities (Area A), the Kittyhawk Area, or downtown (within 10 miles of the base) (11). If the FRN requires feeding, personnel will eat in the billeting area. Rather than move people to messing facitlites, hot lunches or box lunches will be prepared in central messing facilities and then distributed to billeting areas as required. Approximately eight hours prior to departure the FRN will leave billeting and proceed to the passenger staging area. This allows ample time to transport personnel using unit vehicles and still begin processing those vehicles six hours before departure . All deploying vehicles should begin

processing at least six hours prior to departure (7;11).

Once a FRN departs the reception point, the mobility
person directing the FRN (the inchecker) is free to assist
another FRN. One inchecker is required for each FRN.
Unit related personnel deploying from on-base units will
not require an inchecker and will enter the reception
system directly at passenger staging.

Distribution of one box lunch per person and final
troop commander briefings are accomplished at passenger
staging. From there, FRNs will move either by foot or bus
to the passenger terminal. One passenger agent per FRN
will deliver final passenger briefings and distribute
another box lunch for the flight. After final passenger
processing 60% of the FRNs will walk to the aircraft while
40% will require buses (7). The passenger agent will be
free to assist another FRN once his FRN departs to be
loaded on the aircraft. Upon arriving at the aircraft the
FRN departs the reception system.

First-in-first-out (FIFO) priority is used for all
personnel processing and transportation through passenger
staging. Beyond this point the FRN with the earliest
departure time receives priority over other FRNs (11).

CARGO RECEPTION

Arriving cargo is separated into the categories of
unit related (vehicular and non-vehicular), non-unit
related, and explosive. Unit related vehicles must be

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delivered to processing at least six hours before depar-
ture (7;11). Unit cargo and vehicles will arrive at Gate
26C and be directed for processing by a cargo agent at the
reception point. Vehicles will need washing and/or pro-
cessing. Those requiring both washing and processing will
first be washed then proceed to the processing area.
After processing the vehicles will be parked awaiting
joint inspection by the shipper, APOE personnel, and the
aircrew. Vehicles that pass this inspection are parked in
the marshalling area awaiting loading onto an aircraft.
Vehicles that fail this inspection can fail because of
improper washing or processing, and will be rerouted to
correct the deficiency.

Unit related cargo will arrive palletized for air
shipment (10). Pallets with discrepancies discovered
during incheck will be sent to the frustrated cargo area
for rework. Acceptable cargo will be routed to the
marshalling area, unloaded by forklift and inspected by
the joint inspection team. Cargo that passes inspection
will await loading onto an aircraft. Cargo that fails
inspection will be routed to the frustrated cargo area for
correction of deviations. This cargo will then be rein-
spected and if satisfactory be marshallled to await
loading (11).

Non-unit related cargo will be input into the system
from either on-base or off-base sources. Off-base non-

unit cargo will arrive on wooden pallets and will need preparation for airlift (10). It will be received by a cargo agent who examines the paperwork for completeness and determines its destination and time of departure. The cargo is then routed to the unloading/palletizing area. At WPAFB this cargo (as well as explosive cargo) will arrive on flatbed trucks (7). The TPFDD measures this cargo in tons. For modeling purposes all cargo is divided by 1.7 tons (average weight of a pallet) (22) and processed as individual pallet loads. On-base non-unit cargo will not be received through the freight channels. Rather, this cargo will be sent directly to the unloading area for palletization.

After unloading, non-unit cargo is palletized by Air Force crews with continuous inspection by both quality control personnel and one supervisor for every three crews (22). Pallets are then moved by forklift to the marshalling area to await loading onto an aircraft.

Explosive cargo is the most restrictive input to the reception process. Special routing for trucks carrying this cargo is required. Explosive cargo will arrive at gate 26C by prior arrangement with the shippers (7). The mobility representative at that gate will direct the drivers to the explosive area near Taxiway 12 via an approved route, separate from other APOE activity and other base functions. At the explosives area the cargo

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will be unloaded and palletized by Air Force crews as above. Pallets will then await loading onto aircraft.

All cargo will be processed with a priority determined by earliest departure time first. A cargo item that has begun a phase of processing (ie. palletizing, washing, etc.) will not be interrupted for new arrivals with earlier departure times. These arrivals, however, will be ordered in the queue with the earliest departing first.

Most APOE activity will be conducted on the west side of WPAFB. Passenger processing and staging; unit and non-unit cargo processing, inspection, and marshalling; and vehicle processing, inspection, and marshalling will be conducted in the area adjacent to or in buildings 4022, 4024, 4026, and 4028 (7). The location of these functions determines the transit times between the various activities described above.

DATA PREPARATION

The values for the variables listed below have been collected from interviews of mobility experts, actual field measurements, and other sources as indicated. Variables common to all APOE locations are expressed as Uniform distributions (minimum value, maximum value) or Triangular distributions (minimum value, most likely value, maximum value). The type of distribution with the parameters indicated in parenthesies determine the vari-

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able value. Expressing these common variables (eg.pro-

cessing times) this way provides greater realism (13:68)

and a basis for comparison amoung various APOE bases.

Base specific variables like transportation times were

determined by actually driving the routes described or by

expert estimates of their true value (1;7;8;10;11). These

variables are represented by average times. Using distri-

butions rather than average values for base-specific vari-

ables would make the model much more difficult to apply to

different APOEs. In the interest of simplifying the model

application, base-specific distributions are not used.

   The following four categories of variables and their

values are required to use this model. The source of the

value is indicated in parenthesies, where (FS) indicates

field study values and (EST) indicates values estimated by

the authors in consultation with others. All triangular

distribtuion parameters are in minutes.

EXOGENOUS VARIABLES

The weather

Flight time to destination plus clock time change.

Amount of cargo arriving--Extracted from
representative TPFDD data created for model
validation and experimentation (Appendix F).

Number of people arriving--Extracted from
representative TPFDD data created for model
validation and experimentation (Appendix F).

Arrival time of personnel and cargo--Drawn from a
uniform (earliest allowable, latest allowable)

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distribution. The earliest and latest times are
based on the available to load date (ALD). The time
of arrival is randomly selected from this 24 hour
window.

Departure time of personnel and cargo--Drawn from a
uniform (earliest possible, latest allowable)
distribution. The earliest possible departure is
either the earliest time to allow arrival at 0000
hours on the TPFDD earliest arrival date (EAD) or the
actual arrival time plus a minimum processing time.
For personnel the minimum processing time is six
hours (7; 11). For cargo the minimum processing time
is either six hours or two minutes per ton, whichever
is greater (7; 11). The latest allowable time is
the latest that the resource can depart the reception
system and still arrive at the destination by 2400
hours on the latest arrival date (LAD).

Minimum possible time to prepare an FRN--6 hours (7;
11).

Percentage of units with own transportation--50% (7).

Transit time from reception point to:
    Passenger staging--3 minutes (FS)
    Billeting at VOQ--10 minutes (FS)
    Billeting at Kittyhawk--12 minutes (FS)
    Billeting at Commercial Hotels--20 minutes (EST).

Earliest time an FRN may report to passenger
staging--8 hours (7).

Waiting time after dispatching for bus transportation
to reach the pick up point--Drawn from a triangular
(0,10,15) (EST) distribution. The three parameters
represent the shortest, most likely, and longest
times. A bus may be at the pickup point so there
would be no waiting. Fifteen minutes is the longest
it could take to arrive and ten minutes is the most
likely.

Reception point inchecker processing time--Drawn from
a triangular (15,30,60) distribution (7).

Transit time to passenger staging from:
    VOQ--13 minutes (FS)
    Kittyhawk--15 minutes (FS)
    Commercial Hotels--20 minutes (EST).

Processing time at passenger staging--Drawn from a
triangular (30,45,60) distribution (7).

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Transit time from passenger staging to the passenger terminal--2 minutes (FS).

Transit time from the mobility line to passenger staging--30 minutes (EST)

Processing time at the passenger terminal--30 seconds per passenger plus 10 minutes per FRN (7).

Percentage of aircraft parking spaces within walking distance of the passenger terminal--60% (7).

Transit time from the passenger terminal to the aircraft by walking--15 minutes (EST).

Transit time from the passenger terminal to the aircraft by bus--20 minutes (EST).

Cargo agent processing time per pallet--Drawn from a triangular (6,10,20) distribution (7).

Average weight of a vehicle--2.0 tons (EST)

Transit time to washrack from:
    Reception point-3 minutes (FS)
    Passenger staging--2 minutes (FS).

Percentage of vehicles that need washing--75% (1;7;11)

Processing time at washrack--Drawn from a triangular (10,15,30) distribution (7).

Transit time to vehicle processing from:
    Reception point--2 minutes (FS)
    Passenger staging--2 minutes (FS)
    Washrack--2 minutes (FS).

Processing time at vehicle processing--Drawn from a triangular (10,15,20) distribution (7).

Transit time from processing to vehicle parking--3 minutes (FS).

Vehicle joint inspection time--Drawn from a triangular (10,15,20) distribution (7).

Percentage of vehicles that fail joint inspection--4% (7), 20% (1;11).

Percentage of failed vehicles failing joint inspection due to processing--25% (1;7;11).

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Transit time from vehicle inspection to washrack--2 minutes (FS).

Transit time from vehicle inspection to processing--3 minutes (EST).

Transit time to palletizing area from reception point--3 minutes (FS).

Percentage of unit pallets that fail incheck inspection--50% (1; 11).

Percentage of unit pallets that fail joint inspection--4% (1; 7; 11).

Transit time to marshalling area from reception point--2 minutes (FS).

Time to inprocess non-unit cargo--Drawn from a triangular (5,7,15) distribution (7).

Time to unload a pallet from a truck--8 minutes (22).

Time to build/inspect a pallet--Drawn from a triangular (30,45,60) distribution (7; 11).

Transit time from palletizing area to marshalling--3 minutes (FS).

Time to load a pallet on a K-loader--Drawn from a triangular distribution (.6,1,3.) (7).

Average weight of a pallet--1.7 tons (22).

Transit time from marshalling area to frustrated cargo area--3 minutes (FS).

Processing time at frustrated cargo area--Drawn from a triangular (15,60,120) distribution (7).

Transit time from reception point to explosive cargo area--60 minutes (FS).

Time to unload a pallet of explosives cargo from a truck--Drawn from a triangular (10,12,15) distribution (7).

Time to palletize explosives--Drawn from a triangular (45,60,90) distribution (7).

Average weight of an explosive cargo pallet--4 tons (7).

ENDOGENOUS VARIABLES

Number of reception point incheckers—3 (7).

Number of reception point cargo agents—3 (7).

Number of non-unit cargo agents—4 (EST)

Number of passenger agents—9 (22).

Number of unloading crews—6, divided between cargo and explosives (22).

Time before departure that unit vehicles must be turned in for processing—6 hours (7).

Number of palletizing crews—26, divided between cargo and explosives (22).

Number of washracks—2 (11)

Number of forklifts—Unlimited, divided between marshalling area, explosive area, cargo terminal area, and palletizing crews (8;11).

Number of buses—23 (11).

Minimum time before departure to justify billeting—18 hours (1;11).

Number of beds available at:
    VOQ—490 (11)
    Kittyhawk—227 (11)
    Commercial motels—705 (11).

Feeding capacity—4950 meals/shift (11).

Space at reception point—Unlimited (11).

Space at passenger terminal—2000 people (11).

Space at palletizing area—Unlimited (11).

Space at marshalling area—Unlimited (11).

Space at explosive processing/marshalling area—Unlimited (7).

Time before reception system departure to load pallets on a K-loader or move vehicles to the aircraft—1.0 hours (7)

STATUS VARIABLES

Status variables change as the system operates; their values are determined by the system. Such variables as numbers of people awaiting transportation, or cargo awaiting processing resources are indicators of system bottlenecks. These variables can be evaluated to improve effectiveness as measured by the criterion variable.

CRITERION VARIABLE

The criterion variable is the percentage of people, or the percentage of cargo, prepared on time for shipment. The minimum acceptable target value of this variable is determined by the system managers and compared to the simulation value to determine system effectiveness. For this thesis 95% of the cargo and 100% of the personnel prepared on-time were selected as minimum acceptable criterion values. These high values reflect the critical nature of force deployments during a crisis.

ASSUMPTIONS

Mobility/OPLAN operations and requirements take priority over all other base activity (1; 11).

All work centers will operate 24 hours per day, 7 days per week (22).

Cargo and personnel will arrive primarily by truck or bus (22).

Operations will occur in all types of weather (22).

All non-unit cargo will require palletization for air

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transport (10).

Load planning will be accomplished simultaneously with other reception activity and will be completed prior to departure from the reception system (7).

Sufficient K-loaders will be available to handle aircraft loading without inducing reception system delays.

MODEL TRANSLATION

Simulation Language for Alternative Modeling (SLAM) was selected for computerization of the reception model. Because the arrivals and departures during OPLAN execution must fall within not-earlier-than and not-later-than limits, these events must be scheduled. Once assets arrive, they must flow through a process of varying activity best represented by a network. SLAM's capability to combine network modeling with discrete event scheduling allows the required flexibility for this model (12:402-403). The subroutine options available with SLAM also provide additional programing flexibility and thus additional model realism (12:231).

For this study, the SLAM model consisted of a main program, event subroutines, user function subroutines, allocation subroutines, and the network. The main program allows the SLAM internal pointer arrays (NSET and QSET) to be dimensioned to entity attributes and anticipated network activity. Entity monitoring in this model requires nine attributes (eg. arrival time, departure time, amount

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of cargo, number of people, etc., associated with the FRN)
for each entity traveling through the network. Each en-
tity represents a FRN of people, or one pallet of cargo,
or one piece of rolling stock. The SLAM program adds four
internal attributes to each entity, so each modeled act-
ivity requires 13 memory locations in NSET and QSET. The
ASD Cyber will accept AFIT batch jobs requiring up to
350,000 fields of core memory. The SLAM language and the
model code required approximately 200,000 fields of mem-
ory. An analysis of TPFDD data indicated that during some
periods the system may be processing between 4000 and 4500
simultaneous entities. NSET and QSET were dimensioned to
70,000 each, which allows up to 5000 simultaneous enti-
ties. With this dimensioning total core requirements are
approximatly 335,000 fields.

The event subroutine initially reads the input data,
establishes entity attributes, and builds the event file.
During the simulation this subroutine monitors the sche-
duled events and sends them to the network at the appro-
priate time.

The network portion models the various reception
activities calling on user functions to determine certain
variable values (eg. drawing random samples from distri-
butions). Allocation and event subroutines are also
called to assign and free resources (eg. buses).

The original graphic model (Appendix C) evolved into

a SLAM flowchart (Appendix D). From the SLAM flowchart, the simulation model was coded into the SLAM language (Appendix E). A list of variables and resources used in the model is included in the computer code (Appendix E) and explained in the User's Manual (Appendix I).

VALIDATION

A utilitarian model validation was accomplished in a three step (validate, verify, validate) process. Initial validation of the working model consisted of detailed briefings and discussions with mobility experts from transportation, mobility planning, and AFLC War Plans Divisions. After constructing the Integrated Computer-Aided Manufacturing Definition Method (IDEF) and SLAM flowchart models, as well as collecting values for the resources and variables mentioned above, step by step progress through the network was briefed to each of the above agencies. Each briefing included thorough discussions about the model assumptions, resource and variable values, and the network chain of events. Where initial errors were made, the model was adjusted to incorporate the correct value. General agreement was reached by all agencies that the model was an accurate representation of the present WPAFB mobility plan and the resources and variables noted were accurate estimates of available assets (1;7;10).

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Model verification was achieved through the use of user generated input data, SLAM nodal tracing, and user written "debug" statements. User generated data were designed to exercise each path of the network and the output was analyzed to ensure the program's accuracy.

SLAM nodal tracing provided information showing the time of arrival and releases at each node along with selected entity attributes. Analysis of each node arrival and release assured that entities were flowing through the network properly.

The user written "debug" statements were employed to verify the Fortran code used in user functions, event, allocation, and output subroutines. The "debug" statements returned all the user function distribution values as well as other critical activity traces. All routines were verified to be working as intended. The user functions used SLAM routines to generate random numbers and Monte Carlo deviates. Since the Cyber random number generator and SLAM distribution subroutines have been previously evaluated for Goodness of Fit (2), the generated variables were not retested for distribution conformity. From these analyses we concluded the computer code was operating exactly as the model was designed.

Final validation was accomplished through a process very similar to inital validation. Base and MAJCOM level briefings and discussions were again conducted; however,

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the emphasis of these briefings was on model output rather than model mechanics. Various output from runs of the model were analyzed and questioned for accuracy in relation to "real world" mobility reception. The results of this analysis are more thoroughly covered in Chapter 4 and Volume II. All managers agreed that the model and its results were accurate representations of the WPAFB system and its expected capability (1;7;10).

STRATEGIC PLANNING

Shannon's 3-step development of the experimental design was used to accomplish the simulation experiment (13:151). The structural model (the ideal experiment) consists of 28 quantitative factors (essential resources) that could be examined at many different levels. The interaction of these factors determined the information desired from the model: the percentage of people prepared for deployment on-time, and the percentage of cargo prepared for deployment on time. Ideally the most accurate information about the reception system would be provided by varying each factor individually at many levels. However, computer time constraints limited the number of factors and levels actually examined. For example, if the reception model was run at only 2 levels for each factor, 2^{28}, or 268,435,000 separate cells or experiments would be required (13:155). Each cell requires a number of

simulation repetitions for statistical confidence. For this model with hypothetical data, each simulation repetition required approximately 66 seconds of Cyber CPU execution time. This extremely large amount of computer time required greatly limited full factorial experimentation.

To overcome the large number of computer runs indicated by the structural model, the number of levels considered for each factor was reduced in the functional model. To develop the functional model the experiment began at one level for each factor. To fix the proper level for each factor expert estimates of resource availablity presented in the data section were used. The levels represent actual resources available, so they represent management's greatest concern.

An initial simulation of ten runs at the estimated levels for all resources was accomplished. The results of this simulation were then analyzed and bottlenecks (areas of insufficient resources) and excesses were discovered. The factors representing bottlenecks were then adjusted one factor at a time (with ten runs each) to allow for a One-way Analysis of Variance (ANOVA) grouping analysis to determine if changing a particular resource level significantly changed the criterion variable. The experimental model consisted of a randomized block design using the same arrivals and departure times for each block. All activitiy distributions were reseeded for each repetition.

The criterion variable for the simulation is the ratio of personnel or cargo prepared on-time over total personnel or cargo. Since the desired cargo criterion variable is 95% the associated distribution is highly skewed. With this degree of skewness, a normal distribution should not be assumed. For statistical analysis of the blocks, the Kruskal-Wallis nonparametric One-Way ANOVA with multiple comparisons for grouping was selected (5:175-192).

This single factor analysis approach allowed use of the model to evaluate current capability and identify areas of reception processing requiring additonal planning. The model also provided planners with expected changes in the percentages of personnel and cargo prepared on time as individual resources were varied.

TACTICAL PLANNING

Tactical planning considers data collection procedures to minimize variance and determination of repetitions required for statistical analysis and inference. The reduction of simulation induced variance focuses on eliminating start up transients. The criterion variable data for these simulations represent thirty days of activity so initial transient variance is insignificant. Also, for this model start up transients are part of the system and should not be eliminated since base reception will begin on day zero with no entities in the system.

The increased variablility in the early portion of the
system operation actually adds realism to the model and
can be considered the normal confusion associated with the
system start up.

Determination of the proper number of runs for each
simulation for statistical inference depends on the
variance between runs, the nature of the distribution
associated with the criterion variable, variable inde-
pendence, and autocorrelation (13:187,194). The lack of
correlation between runs and independence of the results
are built into the experimental randomized block design
and pose no obstacle for this analysis. The criterion
variable is highly skewed so, a unimodal non-normal dis-
tribution is assumed. Since the distribution is assumed
unimodal the Camp Meidal extension of Tchebycheff's
theorem was invoked to determine the number of runs
required to assure a given level of precision (13:189).

To conserve computer resources with this simulation
the run repetitions were limited to ten. A sample sim-
ulation of ten runs with anticipated resources yielded a
variance of 0.000228. The Camp Meidal k value for 95%
confidence is 2.98. With these parameters, future simu-
lations of ten repetitions are within .014 of the actual
population mean with 95% confidence (13:189).

CHAPTER SUMMARY

Shannon's problem solving paradigm was applied to the APOE reception process at WPAFB. The system was defined, a model formulated and computerized, and data collected and validated. Furthermore, the model was verified and validated and planning for experimentation with the model was accomplished. The following chapter will describe the execution of the experiment, and the results.

CHAPTER 4

EXPERIMENTATION AND INTERPRETATION

This chapter details the experimentation and inter-
pretation steps in the problem solving paradigm. After
carefully developing the model of APC.   )tion, col-
lecting accurate resource data, and planning the experi-
mental design, computer execution of the simulation model
was accomplished. The results of that experiment are
discussed here. Statistical analysis of the results as
well as sensitivity analysis of certain model parameters
enabled accurate interpretation of those results and
pointed out certain strengths and weaknesses of the recep-
tion system plan.

Since actual OPLAN input data (cargo type, quantity,
personnel, timing, etc.) are classified, a data set
resembling actual TPFDD information was created for model
analysis (Appendix F). This data set is used for model
demonstration and is not classified. Actual TPFDD data
were also applied to the model and the results of that
experiment are included in Volume II, which is classified
SECRET.

EXPERIMENTATION

Initial experimentation began by applying the input
hypothetical TPFDD data (Appendix F) to the reception
model with estimated WPAFB resources. The purpose of this
step was to evaluate estimated base capability and iden-
tify excesses and bottlenecks (Appendix G). Ten computer
runs of the model generated average criterion values of
100% for passengers and 83.4% for cargo. Only the
passenger portion of the system produced at acceptable
levels. These runs revealed that a maximum of six buses
were used out of 23 buses available. Furthermore, two
activities, joint inspection teams and palletizing crews
built up significant queues during the simulation
(Appendix G, page 175).

From a planning viewpoint, reception managers could
conserve resources by diverting excesses into more criti-
cal areas. For example, passenger resources may be used
to expedite cargo handling. This action could increase
cargo flow through the system and improve the on-time
cargo percentage without reducing passenger on-time sta-
tistics. To facilitate planning, buses, joint inspection
teams, and palletizing crews were further analyzed.

Buses were evaluated at four levels: five, four,
three, and two buses. Passenger on-time percentages for
five, four, and three buses remained at 100%. With two

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buses, the passenger on-time percentage fell to approx-
imately 99%.

For the cargo network analysis, joint inspection
teams and palletizing crews were individually evaluated.
Joint inspection team levels included five, four, three,
and two teams. Palletizing crew levels of 26, 22, 18, 14,
and 10 crews were also evaluated. A full factor interac-
tive evaluation for two factors at these levels would
require 4^2 + 4 or 20 separate simulations of ten repeti-
tions each. Again to conserve computer resources, an
incomplete exponential factor analysis consisting of eight
simulations was performed and is summarized in Table 4-1.

Group	Joint Inspection Teams	Palletizing Crews	10 Run Average Ratio On Time
1	4	26	.9580
2	5	26	.9842
3	3	26	.8342
4	2	26	.1959
5	4	22	.9644
6	4	18	.9602
7	4	14	.9482
8	4	10	.9095

Table 4-1: CRITERION VARIABLE AVERAGES

In addition to the tests above, the reception model
was evaluated for its sensitivity to errors in the esti-
mates for: (1) the vehicular joint inspection failure
rates for cargo reception and (2) the percentage of units
that will arrive with and continue to use their own

vehicles for transportation during passenger reception. Vehicular joint inspection failure rate was selected for this analysis because of varying expert estimates for its value. Transportation cxperts (7;8) estimated a 4% failure rate, while mobility planners (1;11) estimated failure rates up to 20%. Organic transporation was considered for sensitivity because during adverse weather units may need to turn vehicles into washing early which would increase demand for base transportaion. For the sensitivity analysis the vehicle failure rate was adjusted from 4% to 15% and the percentage of units with organic transportation was adjusted from 50% to 40%. This system was evaluated with the resource levels of 3 buses, 4 joint inspection teams, and 18 palletizing teams. The criterion variable for these ten runs dropped from 96.02% to 50.82% for cargo and from 100% to 99.89% for personnel.

Model experimentation showed that with this hypothetical input data, WPAFB APOE managers can be confident that 100% of the personnel transiting their system will be prepared on-time. For a 95% cargo on-time rate, however, cargo resources must be adjusted.

INTERPRETATION

Statistical and comparative interpretation of the simulation results was accomplished to determine acceptable joint inspection team and palletizing crew

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levels. Kruskal-Wallis nonparametric procedures for
grouping (Appendix H) were employed to determine if the
evaluated resource groupings resulted in significantly
different criterion values. Since nonparametric tests
measure only sample relationships rather than the magni-
tude of the distance between samples, the average criter-
ion values were also compared with the desired system
performance. This analysis approach considered both sta-
tistical grouping and the objective percentage of cargo
prepared on-time.

The Kruskal-Wallis test and group composition are
recorded in Appendix H. This test showed a significant
difference between Group 1 and Group 3 which contain four
and three joint inspection teams respectively, but not
between Group 1 and Group 2 which contain four and five
teams each. With 26 palletizing crews, the criterion
variable average for three joint inspection teams was below
95%, while four and five teams produced values above 95%.
The nonparametric grouping and criterion variable value
eliminate the three palletizing team group as an acceptable
solution. Since with 26 palletizing crews there is no
statistically significant difference between four or five
teams, economically, the better selection is four teams.

The selection of the proper number of palletizing crews
was not as clear cut. Statistically, with 4 joint
inspection teams there was no significant difference

between using 26, 22, 18, 14, or 10 palletizing crews
(Appendix H). Considering only this nonparametric group-
ing analysis 10 palletizing crews would be an acceptable
solution.

The average on-time ratios differ from .9095 with 10
crews to .9644 with 22 crews. These values indicated that
18 palletizing crews with a .9602 average value were the
minimum number of crews that could produce an acceptable 95%
criterion variable. Without an analysis of the simulation
criterion variable variance and associated statistical
confidence level, 18 palletizng crews with 4 joint inspec-
tion teams represents an acceptable choice to satisfy the
desired on-time criterion with minimum resources.

The simulation criterion value variance was calculated
in the tactical planning section. This calculation showed
that with 95% confidence the 10 run average could vary up to
.014 from the true population mean. If the manager requires
95% confidence of a .95 on-time ratio, the simulation
resource levels must produce at least a .9500 + .0140 or
.9640 criterion value. Four joint inspection teams with 22
palletizing crews are the minimum resource levels to produce
an average crierion value over .9640. From this experiment,
planners can determine with 95% confidence that 4 joint
inspection teams combined with 22 palletizing crews will
provide satisfactory system performance.

To obtain the optimum solution the full factorial

analysis should be completed to determine all acceptable

solutions. For example, 5 joint inspection teams with 18

palletizing crews may also provide satisfactory perfor-

mance. From the set of acceptable solutions management can

evaluate the cost of each resource and choose the optimum

combination.

The cargo results of the sensitivity analysis were

included in the ANOVA grouping analysis which confirmed that

the sensitivity group (Group 9) differed significantly from

the comparison group (Group 6). The model is sensitive to

variablility in the percentage of vehicles that fail joint

inspection. When the failure rate was increased from 4% to

15% the on-time percentage dropped over 45%. The true value

of this failure rate requires more study and evaluation to

reduce the disagreement between transportation and mobility

experts. The inspection failure rate should be monitored

during an actual joint mobilization, especially if the

percentage of cargo prepared on-time drops below an

acceptable level. Adjustments in inspection techniques or

criteria could reduce the failure rate and significantly

improve the percentage of cargo departing on-time.

The sensitivity analysis of the passenger network in-

dicated a criterion variable drop from 100% to 99.89%. This

slight drop indicates passenger preparation is not sensitive

to changing levels of organic tranportation.

After determining optimum resource levels, additional

sizing information can be extracted from the SLAM summary

report (Appendix G). For example, at optimum resource

levels, the maximum number of pallets in the marshalling

area at any one time was 835. Using the recommended

pallet storing layout for open storage (19:p2-43,44) these

pallets require approximately 125-square feet of space

each, or 104,375-square feet total. With 266,700-square

feet of pallet storage space available at WPAFB, adequate

storage was provided (7). Similarly, the maximum vehicle

storage space, explosive cargo marshalling space,

unloading, and processing area space requirements can be

determined.

Space requirements can be further evaluated by con-

sidering the amount of paved space available. Unpaved

space for marshalling and processing will probably result

in a requirement for more vehilcle washing and more

inspection failures of vehicles. As shown before, vehicle

inspection failures can severely lower the percentage of

cargo prepared on-time. Furthermore, rain or snow will

soften unpaved storage surfaces and may render forklifts

useless due to mud or ice. The effects of these condi-

tions could be estimated using this model, and plans for

such contingencies can be developed. For example, PSP can

be laid along forklift aisles and loaded pallets could be

set on wooden warehouse pallets. If APOE managers know

that unpaved marshalling will be used (by using the

reception simulation) they can ensure adequate materials are on hand and additional washracks are provided in case of rain or snow.

Billeting requirements can also be determined. For these data, base facilities and contract quarters within ten miles of WPAFB were sufficient to billet all transient personnel. However, if these resource levels had been exceeded, the simulation would indicate the overages, so that planners could take steps to minimize the impact. The use of tents and related equipment such as cots, latrines, and communications networks could be thoroughly planned in advance. Another option would be for reception managers to schedule the arrival of FRNs with large numbers of personnel to ensure that billeting was not required; or spread the arrival times out so that other FRNs vacate quarters before large FRNs arrive.

At the request of WPAFB base mobility planners, the ability to determine box lunch requirements was added to the model. Planners estimated that each departing person would require a box lunch while in passenger staging as well as one lunch upon departure from the passenger terminal to eat during the flight (11). Feeding requirements prior to passenger staging are met in the billeting portion of the model. The box lunch per hour requirements generated with simulated data showed that base capability was adequate.

Workloads for other base agencies can also be estimated from the model. The days with large amounts of cargo and/or personnel arriving can be determined and adequate security police service can be arranged. Similarly, the quantity of cargo departing each day can indicate the number of aircraft arrivals and departures at WPAFB. This information could be used by both air traffic control personnel and base aircraft maintenance personnel in planning parking, fuel, spare parts, and manpower requirements. Proper maintenance planning would include analysis of malfunctions on incoming aircraft and pre-stocking of anticipated parts requiements, as well as ensuring that the proper types of ground servicing equipment is available.

LIMITATIONS

Certain model limitations were observed during the evaluation of the results. The major area that limits the model is the lack of an effective method to plan actual aircraft loads of people and cargo. While movement tables estimate this factor, varying aircraft configurations adversely affect current planning (7;11). For example Civil Reserve Air Fleet (CRAF) aircraft which will accomplish much of the personnel strategic airlift, possess different capacities depending on the type of aircraft as well as the airline from which the aircraft came (17). Further-

more, it is probable that some airplanes will arrive
improperly configured (eg. passenger seats in an airplane
designated to carry cargo). In this situation, the air-
craft may be loaded with passengers rather than cargo to
save the time required for reconfiguration. Passengers
departing early and cargo departing later than expected
could affect the flow of assets through the reception
system by causing back-ups in the passenger terminal or
the marshalling area. Additionally, without specific load
planning, the equipment required to load the aircraft may
be limited which would cause additional backups. Without
accurate estimates of the plane loads of cargo, modeling
K-loader operations, a potentially critical resource, is
impossible.

The solution to this problem lies in the accurate
estimation of which pallets, or groups of passengers will
travel on which airplanes. Until these estimates are
available, the limitation of evaluating the system in
terms of individual FRNs or pallets instead of plane loads
of cargo or personnel will exist.

Another major limitation of current planning is the
omission of retrograde cargo and returning personnel
(10). Storage and handling requirements of cargo return-
ing from the conflict area will require space, facilities,
personnel, and equipment resources. Returning non-comba-
tants and wounded personnel will also use resources in

competition with the deployment operation. Without estimates of this additional workload (10) the impact on the reception system is unknown. Depending on the number of U.S. non-combatants in the crisis area, this additional workload could also severely hinder the deployment effort.

CHAPTER SUMMARY

Experimentation with the computerized base reception model was accomplished using simulated TPFDD data. The results of this experiment were analyzed statistically to determine the optimum resource levels. The model was also tested for system sensitivity to changing parameters. The combination of estimated base resources did not meet the requirments of the cargo criterion variable. Acceptable performance in the modeled system was achieved by reducing the buses required to 3, increasing joint inspection teams to 4, and decreasing the palletizing crews to 22. Additional information about maximum workloads for box lunch preparation, billeting, and space requirements was extracted from the model and its planning value discussed. The limitations to the model were also identified and their impact on the model results was explained.

A similar experiment and interpertation was accomplished using actual TPFDD warplan data. Description and analysis of that experiment is presented in Volume II which is classified, SECRET.

CHAPTER 5

IMPLEMENTATION AND RECOMMENDATIONS

Answering the research questions and meeting the

objective described in Chapter 1 is only the first phase

of model implementation. Management must be informed of

the simulation results so that they can incorporate this

information into the decison process. Finally, the users

should constantly attempt to improve the model to obtain

the most meaningful results. This chapter reviews the

research questions and objective, summarizes user and

management level briefings, and proposes recommendations

to further improve the model.

RESEARCH QUESTIONS

The research questions from Chapter 1 provide a

framework for the conclusions drawn from this effort.

What are the critical factors representing the reception process?

The critical resources were fully ascertained through

detailed interviews with MAJCOM and base level planners

and evaluators. These experts verified that all the major

factors of the reception system were considered and in-

cluded in the model. With the hypothetical TPFDD, joint
inspection teams and palletizing crews were the most
critical factors.

What are the duration distributions associated with reception activities?

Activity durations were determined through a process
that integrated field study results with expert estimates
and documented values. To aid model application to dif-
ferent APOEs, durations which were base specific were
expressed by average values. Those factors that were not
base specific (eg. palletizing and other general proces-
sing times) were expressed as distributions. These dis-
tributions account for the variability inherent in these
processes and added realism to the model. The parameters
of these distributions were again gained from expert esti-
mates and documented planning factors.

What technique will best validate the reception model?

Real world validation of this type of model is
impossible, so the authors employed a utilitarian vali-
dation technique used by the simulation experts at Head-
quarters Military Airlift Command (15). This technique
involved developing model logic, and experimentation with
the model paramenters. The model structure, and simu-
lation results were evaluated by MAJCOM and base level
reception technicians and managers to ensure an accurate

appraisal. All evaluators accepted this model as an accurate representation of the actual reception system. Acceptance by the most knowledgable managers in the mobility/reception field is strong evidence that the model is valid. Furthermore, WPAFB managers are using the simulation results to aid their planning process (1;7).

Does the simulation identify critical shortages?

The reception model output, through queuing and resource utilization summaries, clearly indentified critical shortages in existing plans and produced resolution of those deficiencies through simulation experimentation. These shortages are best observed in Volume II where the synergistic effects of insufficient resources are most dramatically demonstrated.

CONCLUSION

In answering these research questions the research objective was fully met. The model provides managers with an effective planning tool that integrates OPLAN movement data with reception processing requirements. The computer simulation provides validated estimates of time-phased workloads that can be used in planning APOE reception systems as well as allowing experimentation to determine optimum resource levels. Peak workload information may also be applied to related base service functions (eg. security police and transient maintenance personnel) to

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ensure adequate resources in those areas.

A User's Manual provides model application and modi-
fication instructions.   With these instructions, planners
can easily adapt the model to different APOEs or varying
system conditions.

IMPLEMENTATION

The model was developed in conjunction with base
level mobility planners (1;7).   They have accepted the
final simulation results (Volume II) as accurate and are
using these results for sizing estimates.   The WPAFB
senior management (Wing Commander and Crisis Action Team
Members) were briefed on the simulation findings to pro-
mote base level interagency implementation coordination.
The model and Volume II results were presented to the
Headquarters AFLC mobility planning staff to demonstrate
model applicability of other AFLC APOEs.   Headquarters
USAF/LE was briefed for model application to APOEs
throughout the U.S. Air Force.   Finally, the model and
Volume II results were presented to the Forecasting and
Planning working group at the 1983 Military Operations
Research Society symposium to promote incorporation of
this model into other simulation research efforts.

RECOMMENDATIONS

Recommendations for the application of this research fall into three categories: model use, model improvement, and model incorporation.

MODEL USE

The model should be used at base level and by MAJCOMs to evaluate current reception plans and base capability. Shortage areas identified by the model should be fully evaluated and plans should be altered to eliminate those deficiencies. In order to fully exploit the many facets of this model, a qualified individual holding an advanced degree in Logistics Management from AFIT should be assigned to each APOE. This would ensure adequate consideration of the many logistics issues involved in the reception process. APOE bases that do not have the ability to run this computer model should procure that ability or coordinate with other commands that can process SLAM programs.

MODEL IMPRUVEMENT

The model should be improved by constant review of model parameters, by obtaining accurate estimates of plane loads of cargo and personnel, and by developing accurate estimates of retrograde cargo and returning personnel. As palletizing techniques or other processes are improved or changed, parameters must be adjusted to reflect the actual

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values. The dynamic nature of base reception and its many aspects requires continuing model update.

More detailed planning should be accomplished to provide APOE managers accurate estimates of outbound plane load capacities and schedules so that cargo and personnel processing can be evaluated in terms of plane loads. This would allow a more accurate computation of cargo and personnel departing the base on time. It would also allow for modeling of the aircraft loading function. Actual aircraft scheduling and loading will affect the amount of cargo and personnel actually departing the APOE on time. These improvements to the reception model would make it a more realistic and effective planning tool.

Returning cargo and personnel, which will place demands on the reception system should also be studied. The effect of retrograde cargo and personnel would be minimal for OPLANs concerned with such areas as Southwest Asia. However, a conflict in Europe would create a flood of non-combatants to the U.S. that could cripple the mobility effort. Evacuation plans for non-combatants and casualty estimates for various areas could be used as a basis for this evaluation. Once the amount of returning cargo and personnel is estimated, destinations could be predicted and APOE managers could plan for this additional workload. Once the estimates are made, these factors could be added to the computer model to test their effect.

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on the system

MODEL INCORPORATION

The reception model should be incorporated into
other computer planning models, (specifically MAC's M-14)
to add realism and accuracy to larger scale planning
tools. The MAC M-14 model simulates the worldwide
strategic airlift system and includes aircraft scheduling,
maintenance, loading, turn-around times and flight times.
MAC presently uses average times for the reception process
in the M-14 and assumes that 100% of the cargo will be
prepared on time (15). The addition of this model to the
M-14 would enable evaluation of the MAC system's response
to cargo and personnel not prepared on-time. These delays
will affect the flow of personnel and equipment to meet
OPLAN requirements. Incorporation of the reception model
into the M-14 would add the realism of varying cargo and
personnel processing and thus enhance the accuracy of the
M-14 strategic model. The SLAM reception model will be
compatable with the M-14 which is being translated from
the GASP IV computer language to SLAM (9), and its
incorporation into the M-14 should be relatively easy.

CHAPTER SUMMARY

The original research questions were reviewed and briefly answered. The researchers concluded that all the questions were answered and the original research objective was fully satisfied. Base level, MAJCOM and service level managers were briefed to encourage implementation of the experimental findings. Recommendations for model use, improvement, and incorporation were suggested.

APPENDICES

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APPENDIX A

ACRONYMS

ADP	Automatic Data Processing
ALC	Air Logistics Center
ANOVA	Analysis of Variance
APOE	Aerial Port of Embarkation
CONUS	Continental United States
CRAF	Civil Reserve Air Fleet
EAD	Earliest Arrival Day
FRN	Force Requirement Number
JCS	Joint Chiefs of Staff
JDA	Joint Deployment Agency
JOPS	Joint Operations Planning System
JSPS	Joint Strategic Planning System
LAD	Latest Arrival Day
MAC	Military Airlift Command
MAJCOM	Major Command
MCC	Mobility Control Center
MTMC	Military Traffic Management Command
OPLAN	Operation Plan
POD	Port of Debarkation
POE	Port of Embarkation
SLAM	Simulation Language for Alternative Modeling
TPFDL	Time-Phased Force Deployment List
TPTRL	Time-Phased Transportation Requirements List
TTFDD	Time-Phased Force Deployment Data
TUCHA	Time Unit Characterisitcs

WIN   WWMCCS Integrated Network

WMP   USAF War and Mobilization Plan

WPAFB   Wright-Patterson Air Force Base

WWMCCS   Worldwide Military Command and Control System

UTC   Unit Type Code
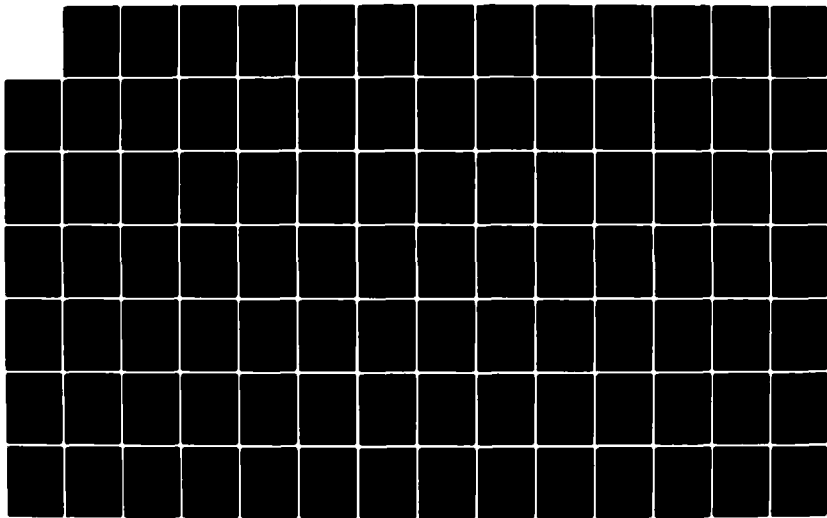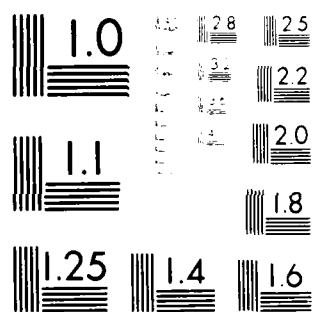
APPENDIX B

WARPLAN DEVELOPMENT

DoD warplans reflect national command authority guidance as indicated by the Joint Strategic Planning System (JSPS). The JSPS contains a series of long range strategic plans (fifteen year or longer projections) developed at the Joint Chiefs of Staff (JCS) level. These strategic plans assess current and projected world conditions and task the theater unified commanders to develop specific plans to support the interests of the United States.

The theater unified commander analyzes specific contingencies and prepares necessary estimates, develops a concept of operations, and tasks the Service component commanders to develop supporting plans. When the JCS approves the basic plan, all tasked agencies prepare supporting operation plans (OPLANs). Supporting Air Force major commands (MAJCOMs) will submit their OPLANs to the theater Air Force component command having primary planning responsibility (20:31).

The JCS recognized the overwhelming difficulty in coordinating Service plans in support of joint military operations; so, in 1970 they approved the Joint Operations Planning System (JOPS). JOPS guidance consists of four volumes which consolidate policies and procedures for the development, review, and approval of joint plans. The JOPS provides an automatic data processing (ADP) support system which serves as a consolidated planning data

source. The objective of JOPS is the timely development
of adequate, suitable, and feasible operation plans
(20:15).

USAF MAJCOMs must use the USAF War and Mobilization
Plan (WMP) for current Air Force policies and planning
factors for the conduct and support of wartime opera-
tions. The WMP also establishes requirements for develop-
ing mobilization and production plans to support sustained
contingency operations, as well as specific planning func-
tions necessary to match facilities, manpower, and mater-
ial with planned wartime activities (20:19).

Detailed Air Force planning begins with a projected
inventory position with respect to units, aircraft, mis-
siles, personnel and installations. The projectd inven-
tory positon estimates Air Force assets by unit type code
(UTC). A unit type code package represents a certain
capability, such as an airlift squadron. Each UTC has a
specific defined mission capability. Planners identify
force requirements and available assets by UTC rather than
by specific military organizations.

JOPS III provides the standard data files, format,
and application programs for force planning (20:34). The
JOPS III application programs analyze the force projec-
tions to determine unit related resources, and non-unit
related cargo and personnel requirements as well as an
initial transportation feasibility estimate. Unit related

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resources include equipment or accompanying supplies and personnel identified with a specific UTC. Equipment and personnel not identified with a specific UTC, primarily replacement resources and spares, deploy as non-unit related resources (16:x). The product of the JOPS III effort is the Time-Phased Force Deployment Data (TPFDD).

The TPFDD consists of two data files, the Time-Phased Force Deployment List (TPFDL) and the Time-Phased Transportation Requirements List (TPTRL). The TPFDL lists the type of units to support an OPLAN, and data concerning their routing from origin to destination. The TPTRL lists force movement characteristics, non-unit related cargo characteristics and routing, and non-unit related personnel data (20:36). The specific TPFDD information includes types of forces required, Type Unit Characteristics (TUCHA) movement data, proposed routing information, proposed origin, proposed ready to load date at origin, earliest and latest arrival at the Port of Debarkation (POD), desired POD, required delivery date at destination, non-unit records, non-unit routing data, and providing organization (16:p.4-2). The Joint Deployment Agency (JDA) is responisble for maintaing the TPFDD. Planners have access to the TPFDD through the Worldwide Military Command and Control System (WWMCCS).

MAJCOMs must evaluate their capability to support the TPDFL force requirements and report deficiencies to the JCS

(20:41). The Military Airlift Command (MAC) and the Military Traffic Management Command (MTMC) must assess lift support capabilities and align lift resources with TPFDD requirements (20:41). They prepare lift restricted movement tables which provide information concerning the scheduled movement to the POE, intermediate locations, POD, and destination. Additional information includes transportaion mode and source, tons of cargo, number of personnel, and arrival dates and location for each required movement (20:256). The JDA monitors CONUS movements and intertheater deployments involving common-user lift, and maintains the MAC and MTMC movement tables (16:p.2-2).

Transportation planning is a significant factor in the development of the final plan for any operation. Transportation planning should indicate the concepts for movement and reception of all forces, identify facilities to be used in the reception of forces, and identify limiting factors which could adversely affect mobility operations. Total movement requirements to include combat and support unit strategic deployment, deployment of replacement and filler personnel, filler shortages of prepositioned war reserve stock, items of equipment required by theater in-place units to make them combat effective, resupply, and movement of retrograde cargo must be considered (20:186). The transportation plan as

reflected in the movement tables should consider all the

forces and supplies needed by the OPLAN, and show how

these resources will be routed through the various ports

of embarkation to reach the destination.

APPENDIX C

GRAPHIC MODEL

PERSONNEL

CARGO

APOE RECEPTION
PROCESSING

TPFDD

REGULATIONS

SAFETY
CONSIDERATIONS

PERSONNEL

VEHICLES

FACILITIES

MATERIAL

PERSONNEL PROCESSED
FOR DEPLOYMENT

CARGO PROCESSED
FOR DEPLOYMENT
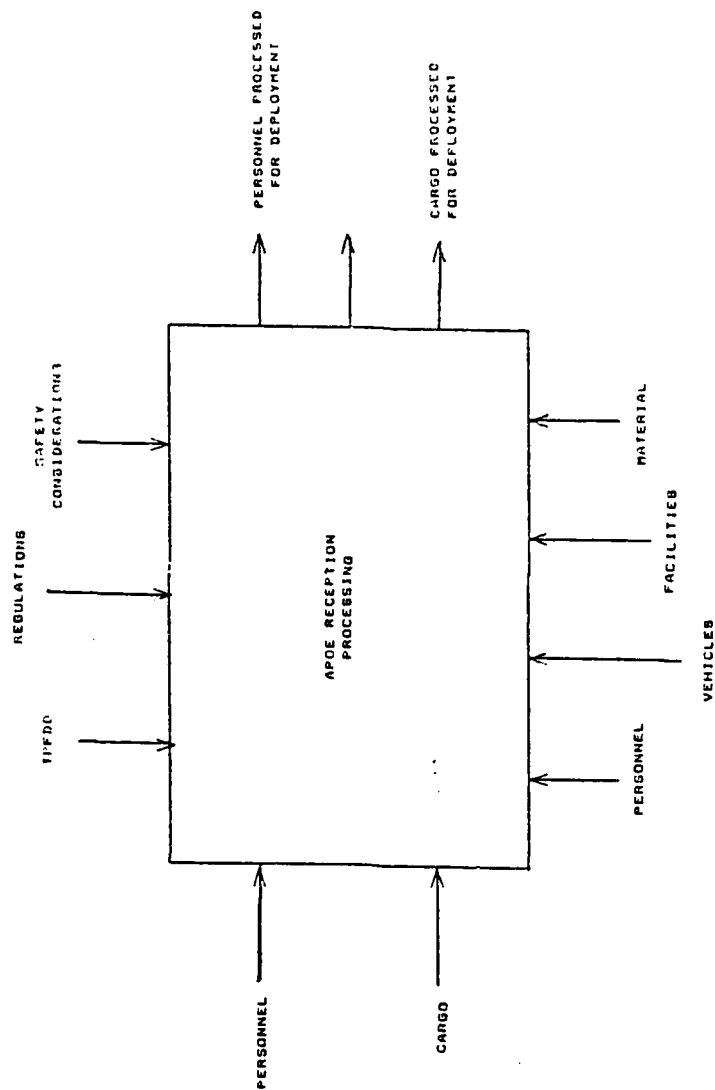
FIGURE C-1: APOE RECEPTION PROCESSING
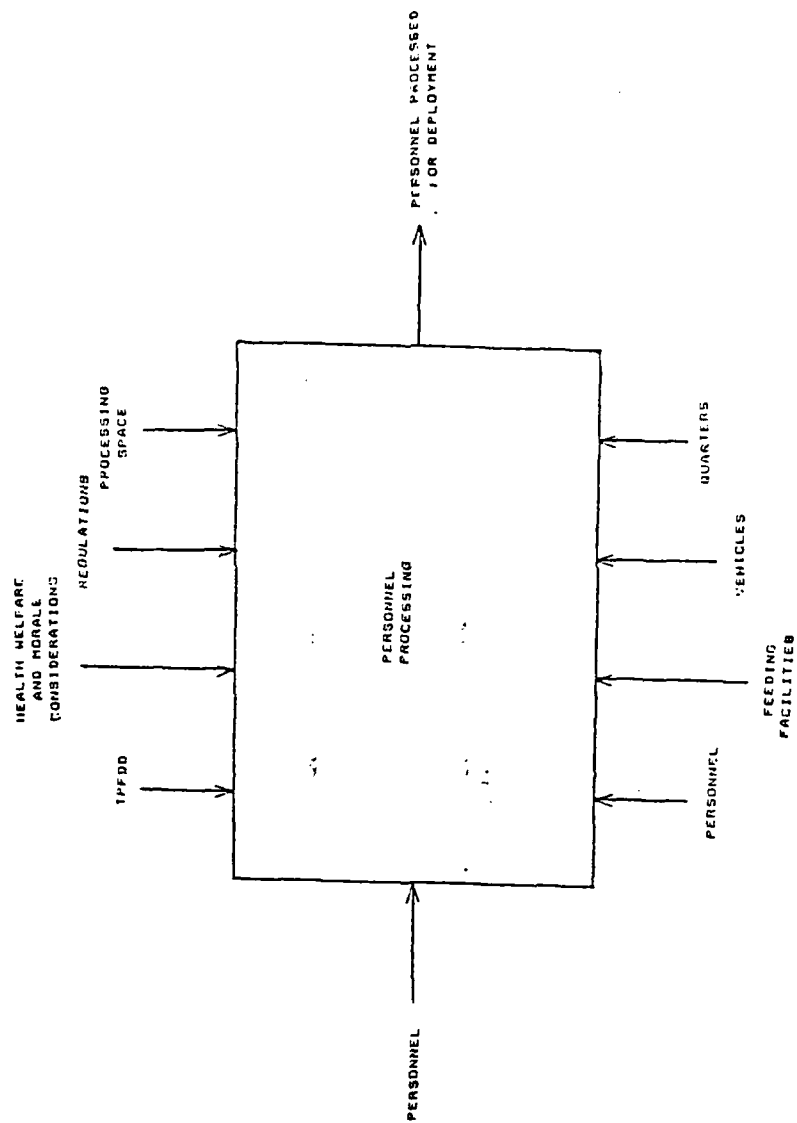
FIGURE C-2: PERSONNEL RECEPTION

FIGURE C-3: PERSONNEL PROCESSING

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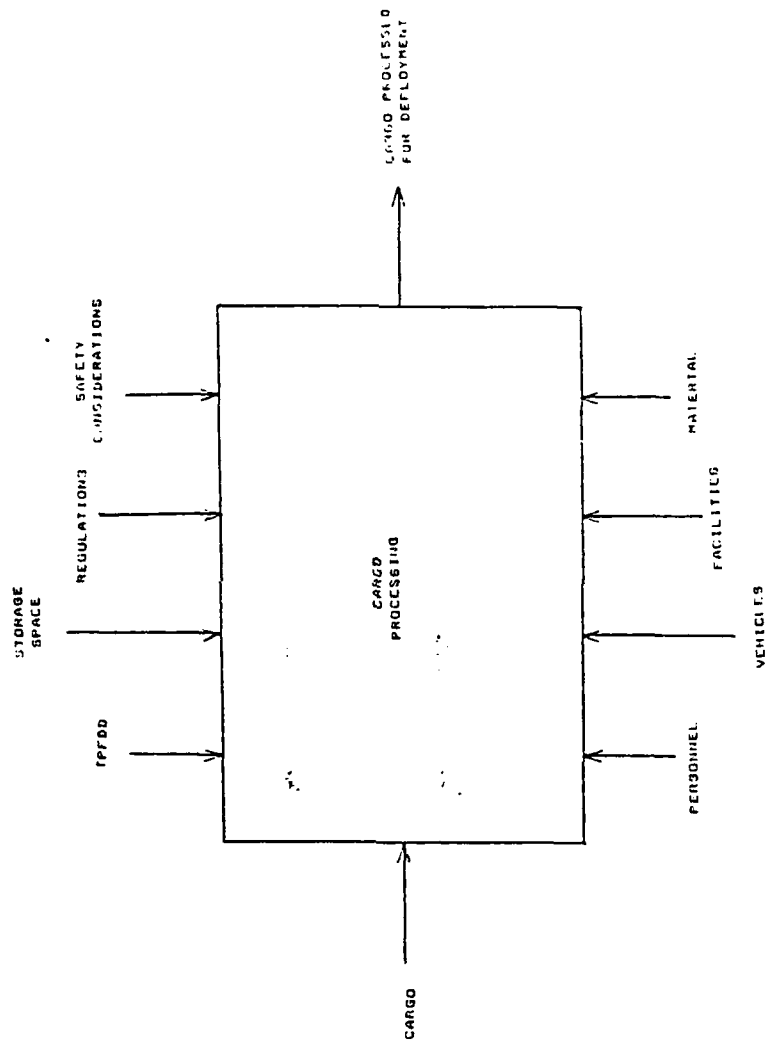
FIGURE C-4: CARGO RECEPTION

FIGURE C-5: UNIT RELATED CARGO PROCESSING
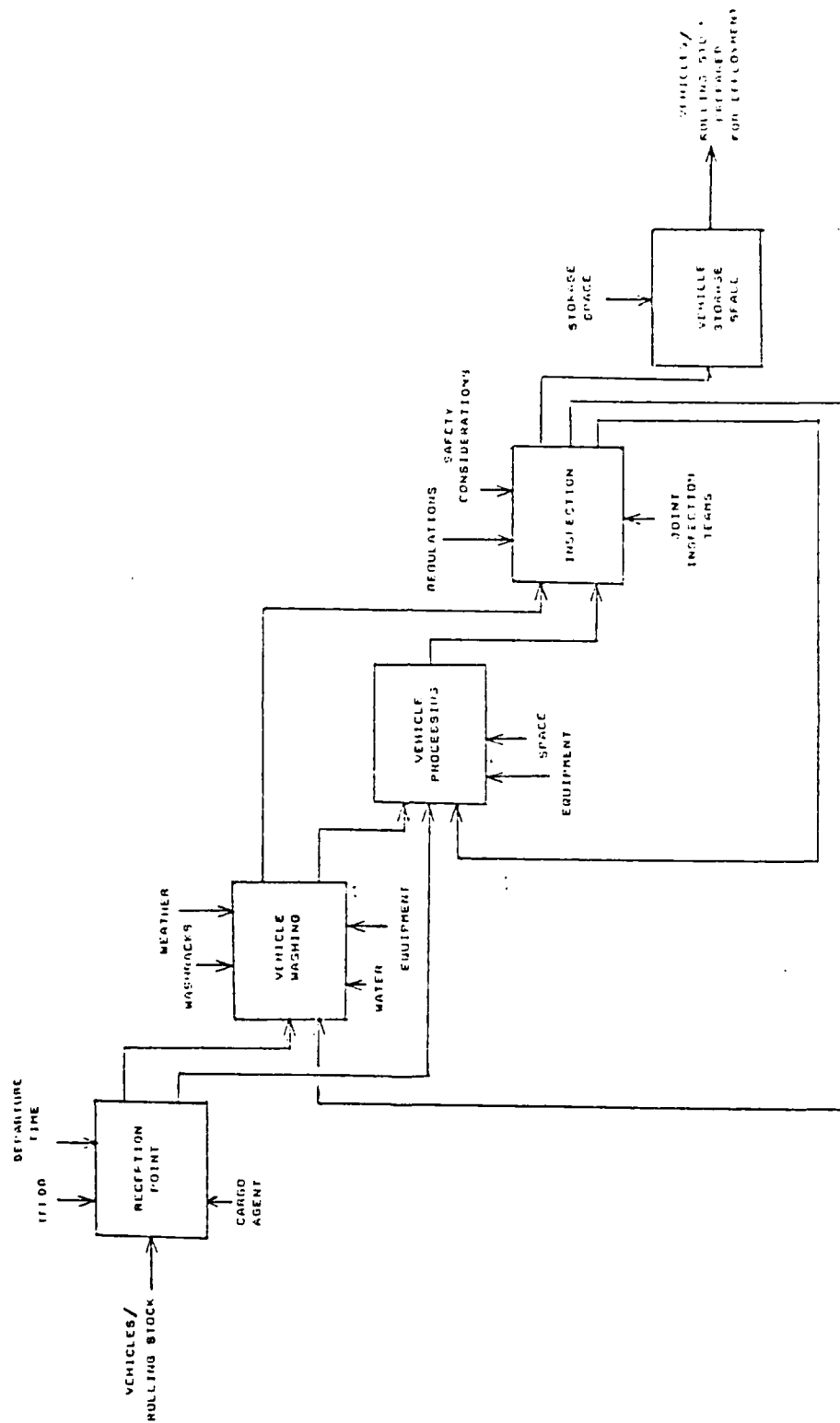
FIGURE C-6: VEHICLE PROCESSING

94
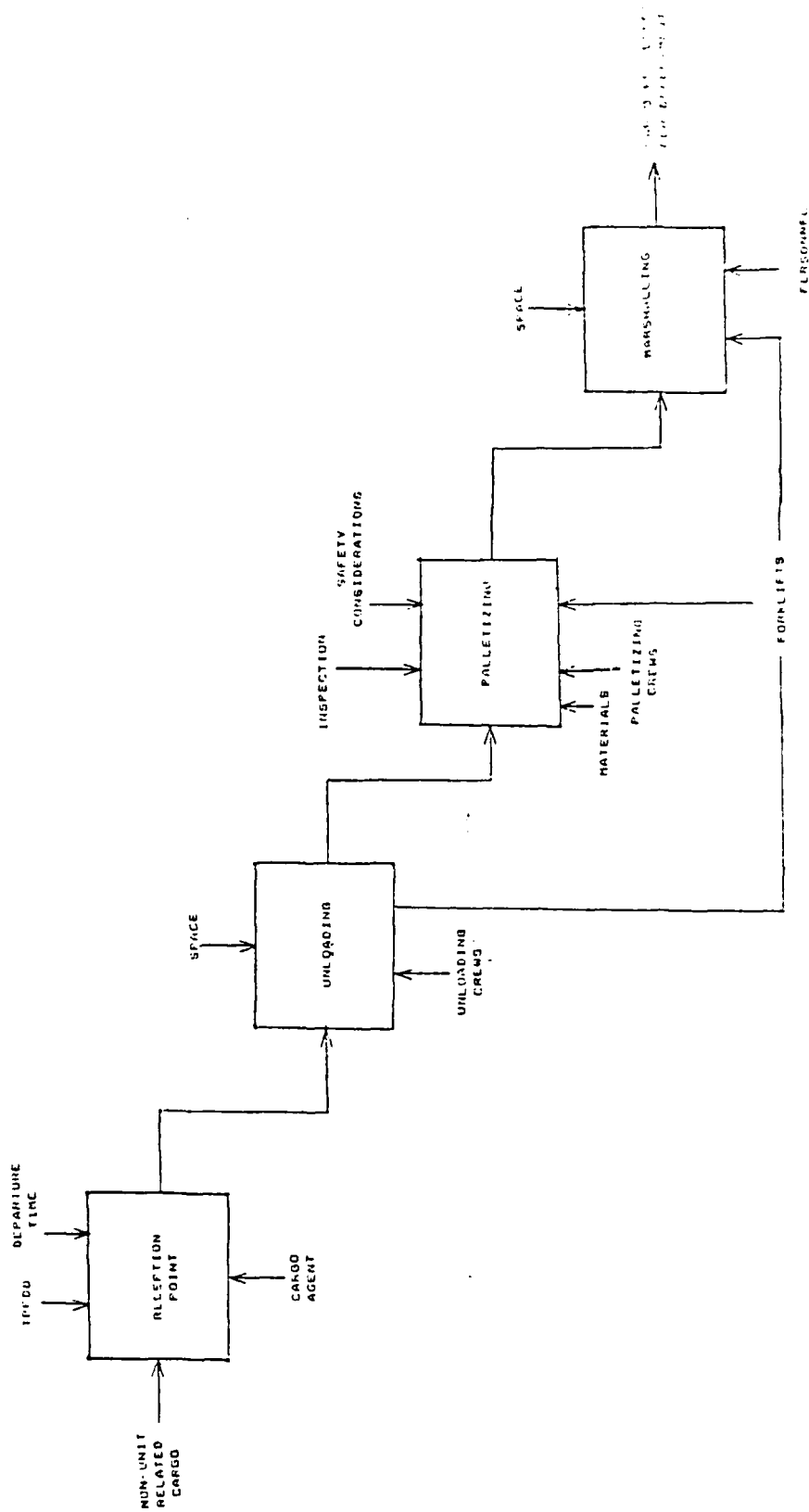
FIGURE C-7: NON-UNIT RELATED CARGO PROCESSING
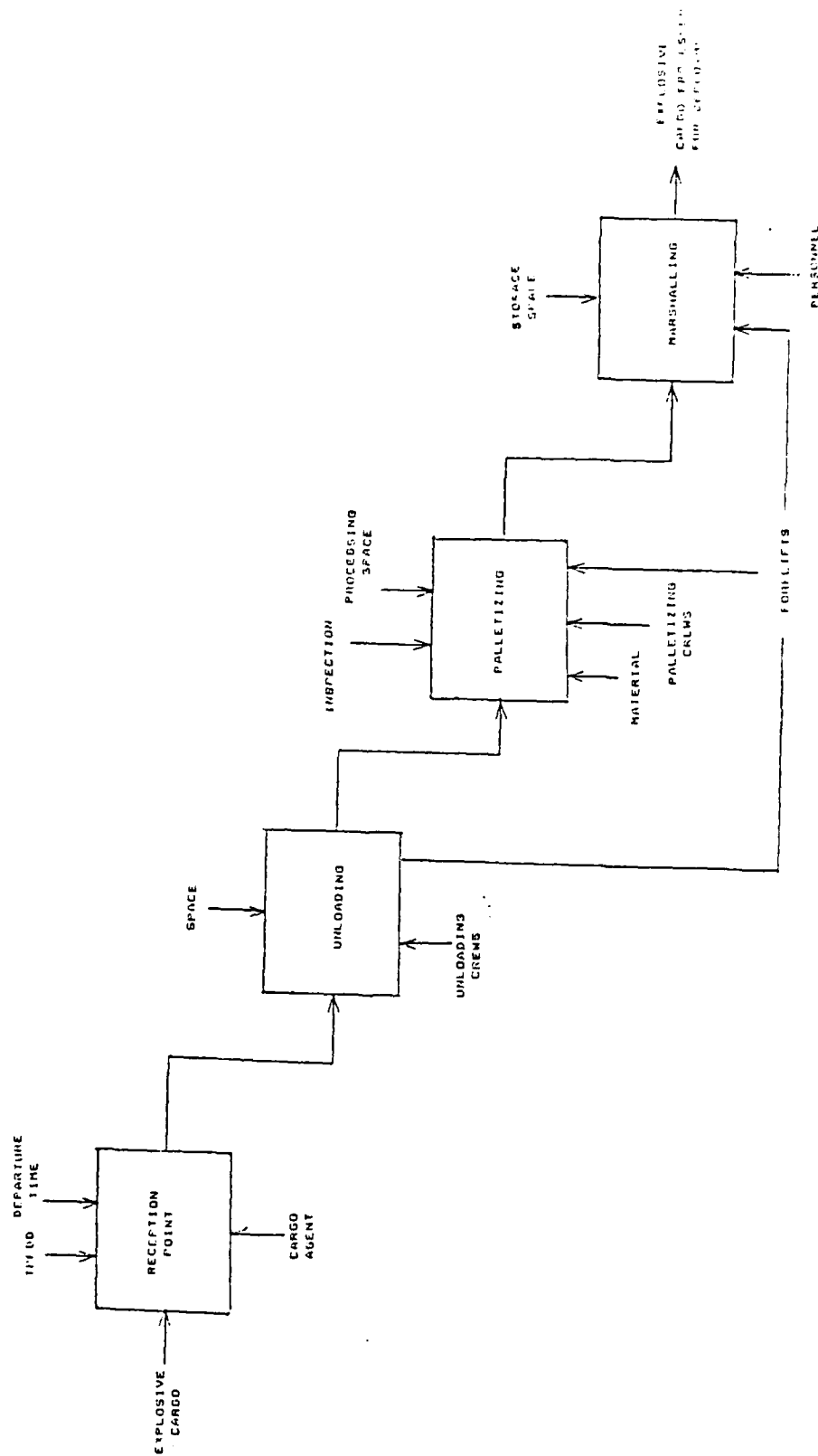
FIGURE C-8: EXPLOSIVE CARGO PROCESSING

APPENDIX D

SLAM NETWORK FLOWCHART

FIGURE D-1: FRN ARRIVALS

98
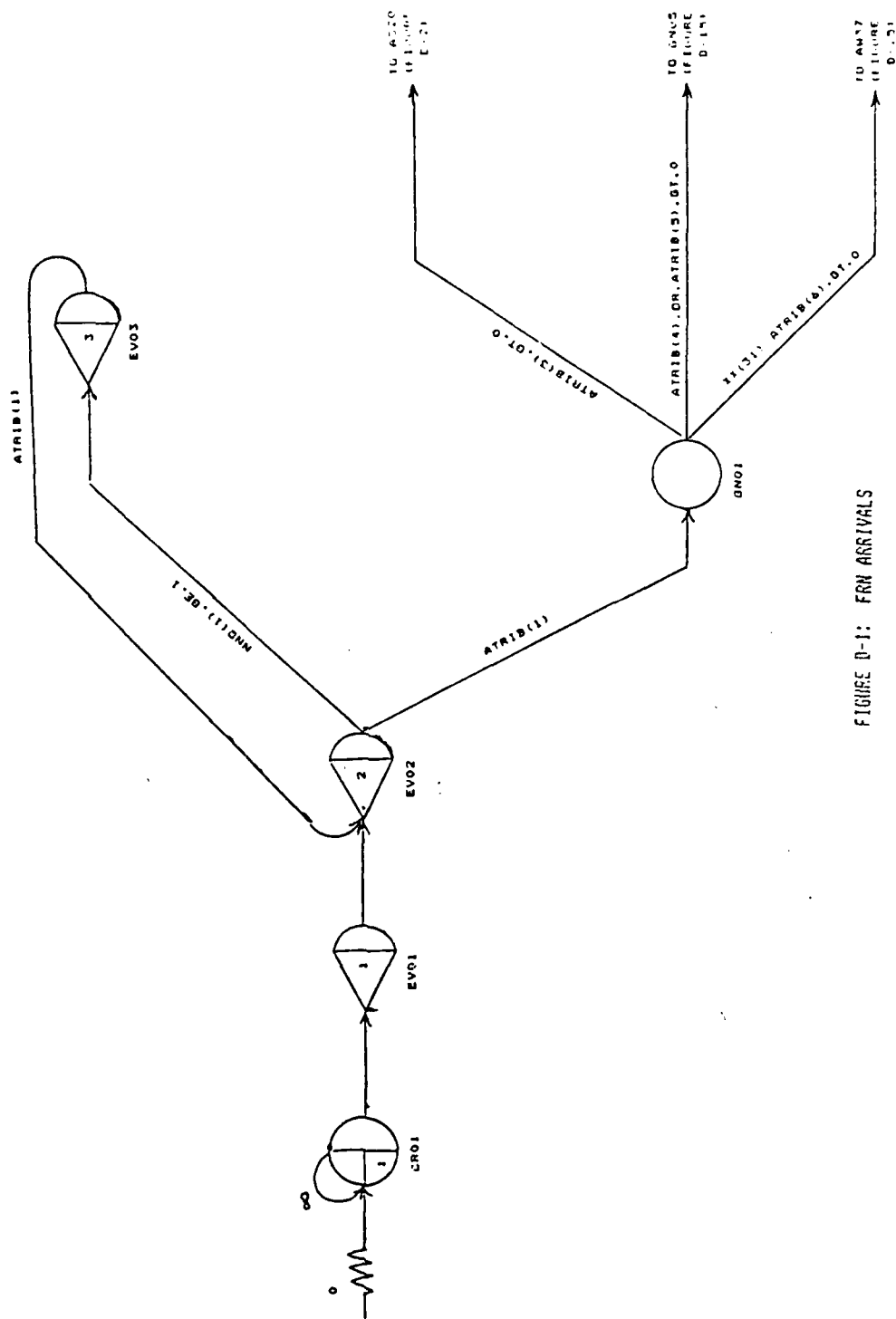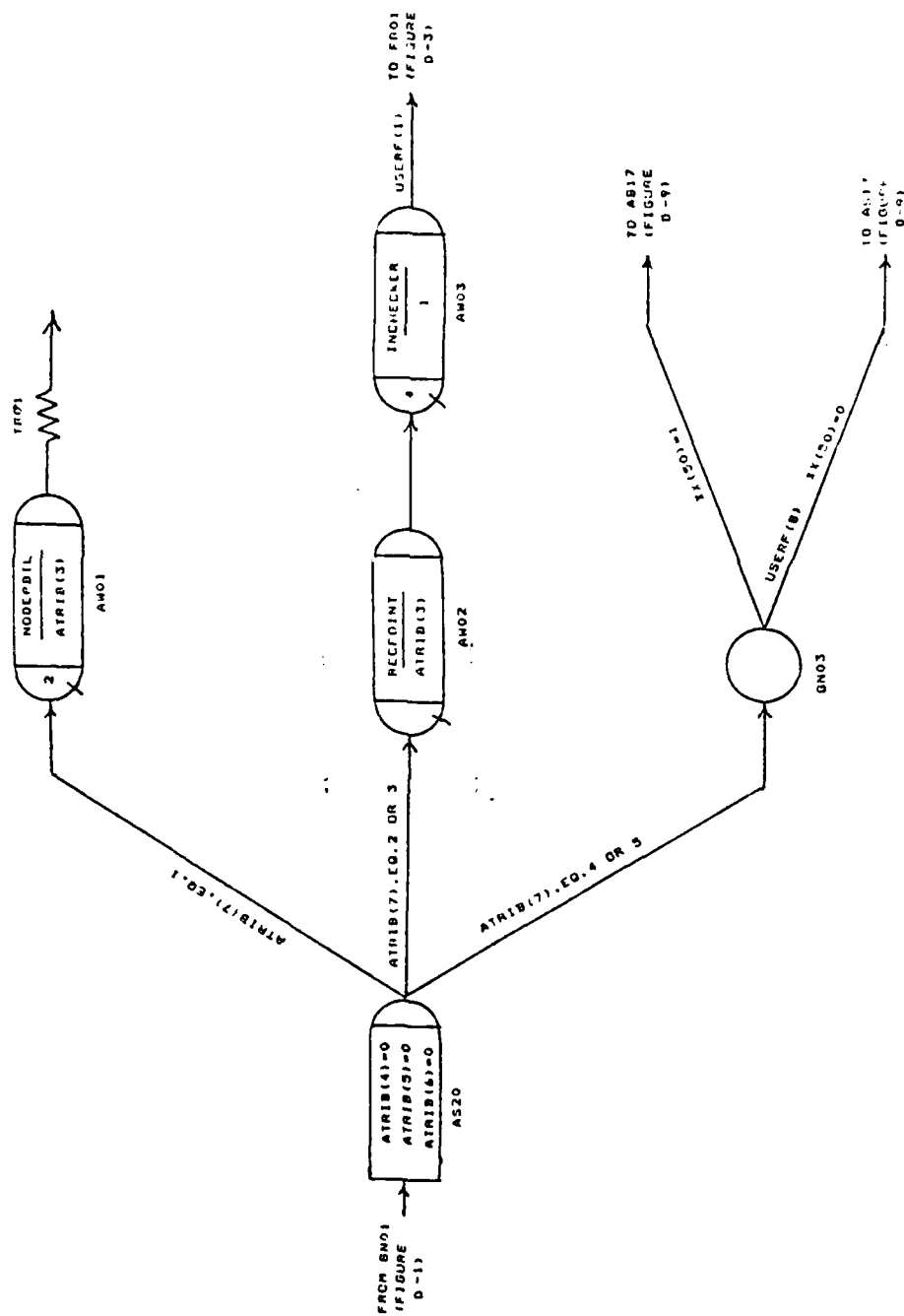
FIGURE D-2: PERSONNEL RECEPTION

INCHECKER

FRO1

ATRIB(1)=USERF(2)
ATRIB(7)=USERF(11)
ATRIB(9)=USERF(20)

AG01

RECPOINT
ATRIB(5)

FR25

ALLOC(1)

AW24

USERF(D) ATRIB(1).LE.XX(8).AND.ATRIB(9).EQ.1   TO AW13 (FIGURE D-4)

USERF(N) ATRIB(1).LE.XX(8).AND.ATRIB(9).EQ.0

ATRIB(1).GT.XX(8)

ATRIB(1).LT.XX(8)

ATRIB(1).GT.XX(D)   TO AW04 (FIGURE D-5)

XX(42)   TO AW25 (FIGURE D-10)

FROM AW03 (FIGURE D-2)
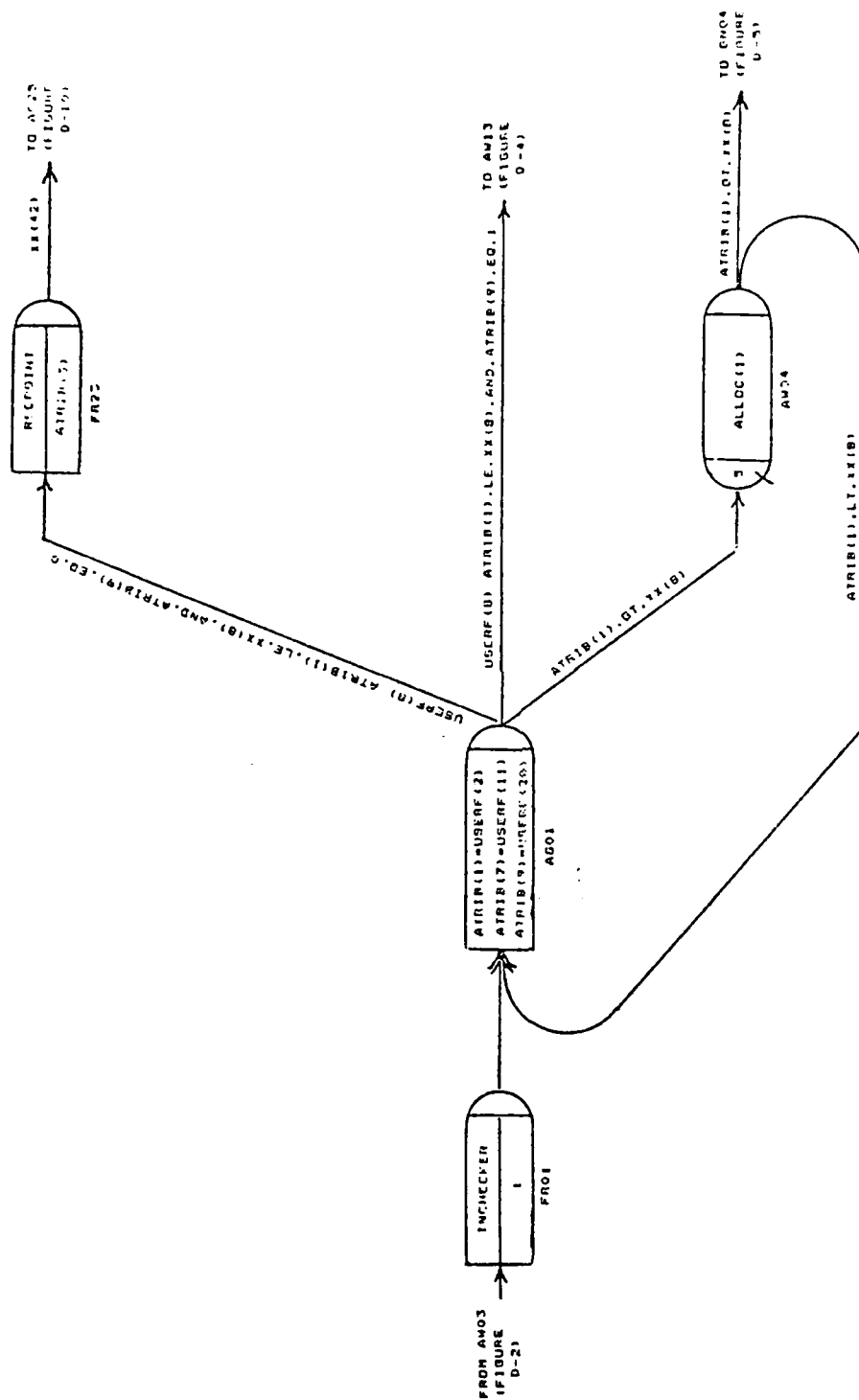
FIGURE D-3: BILLETING ALLOCATION
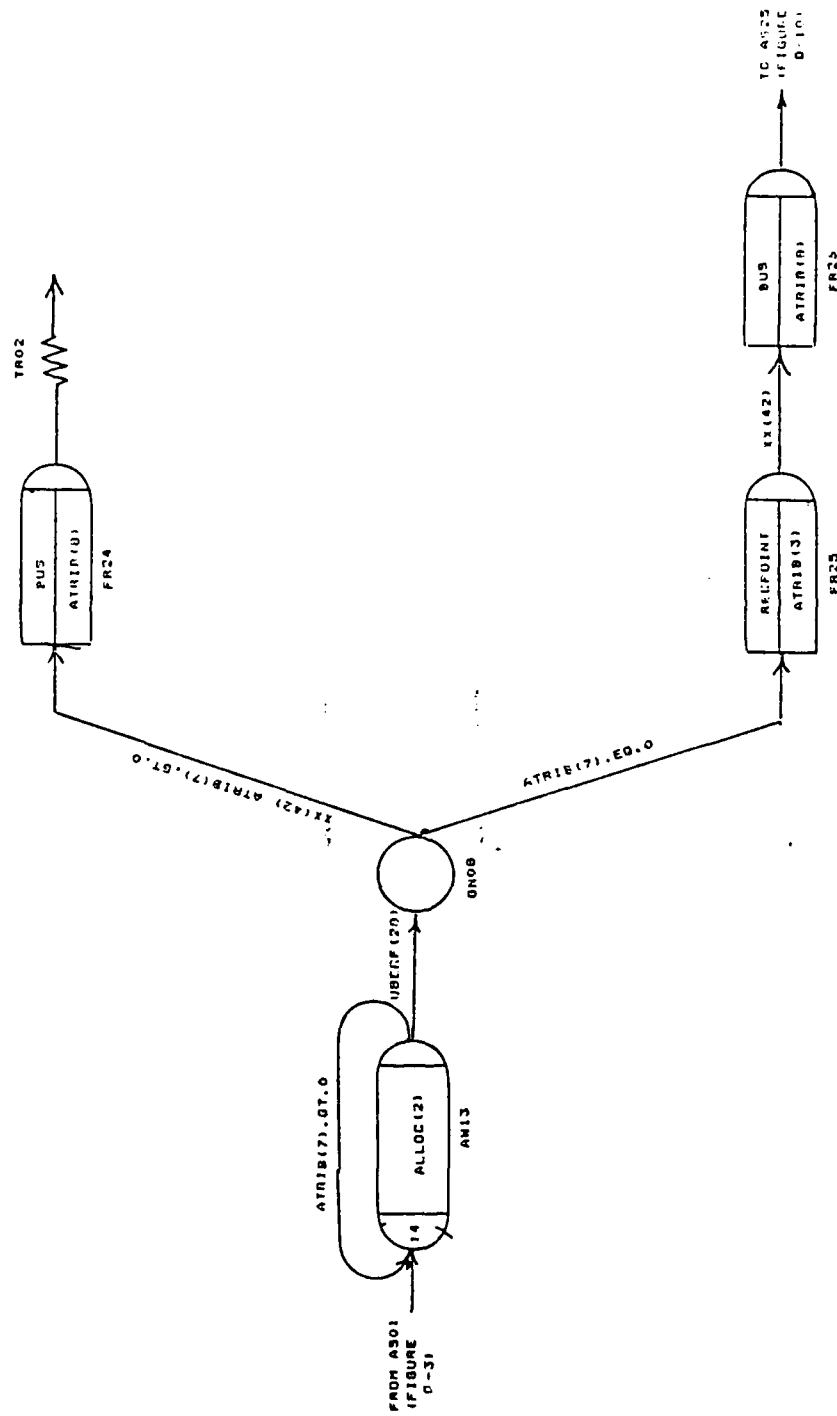
FIGURE D-4: BUS TRANSPORTATION FROM PASSENGER RECEPTION TO STAGING
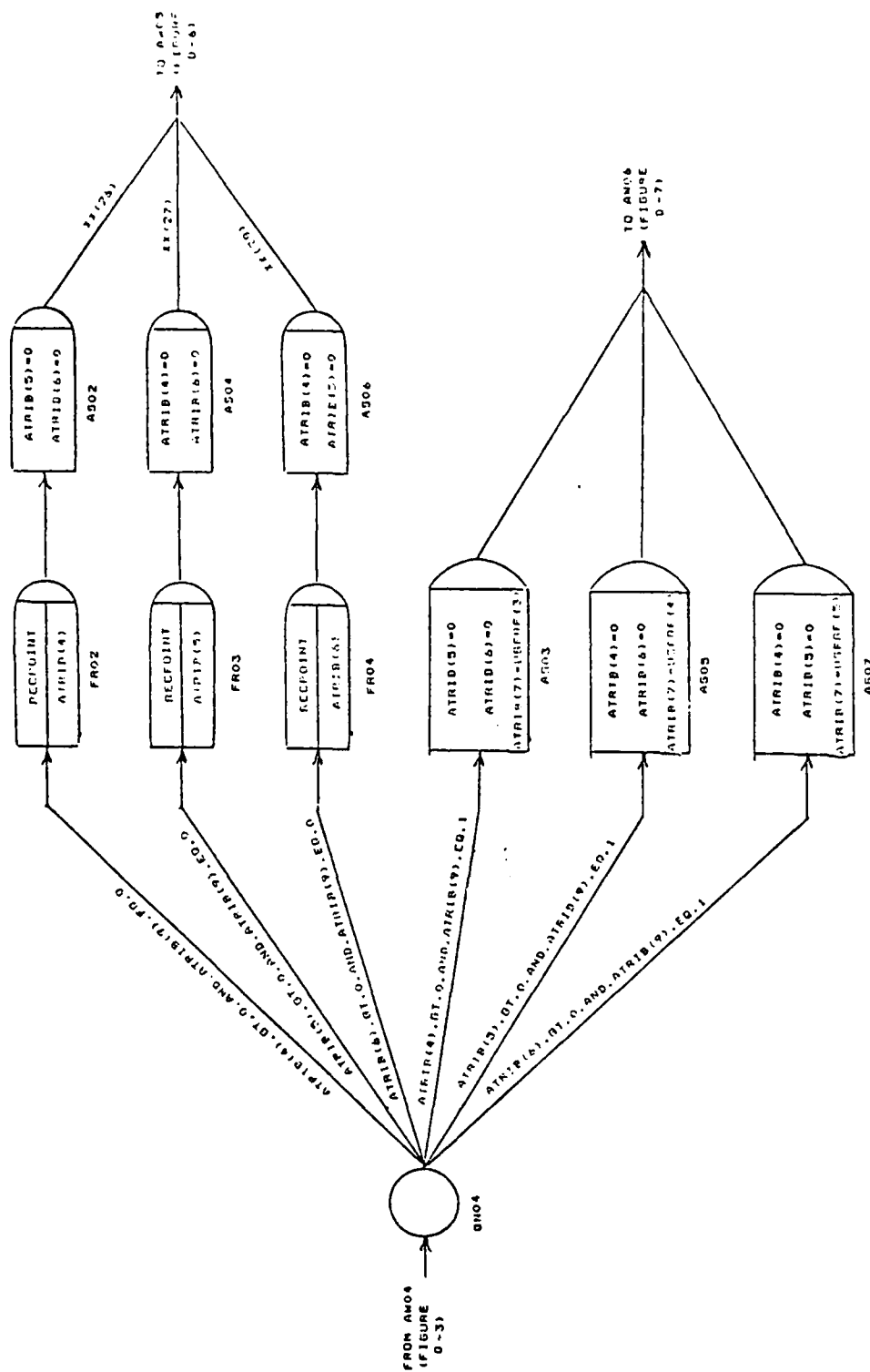
FIGURE D-5: TRANSIENT BILLETING
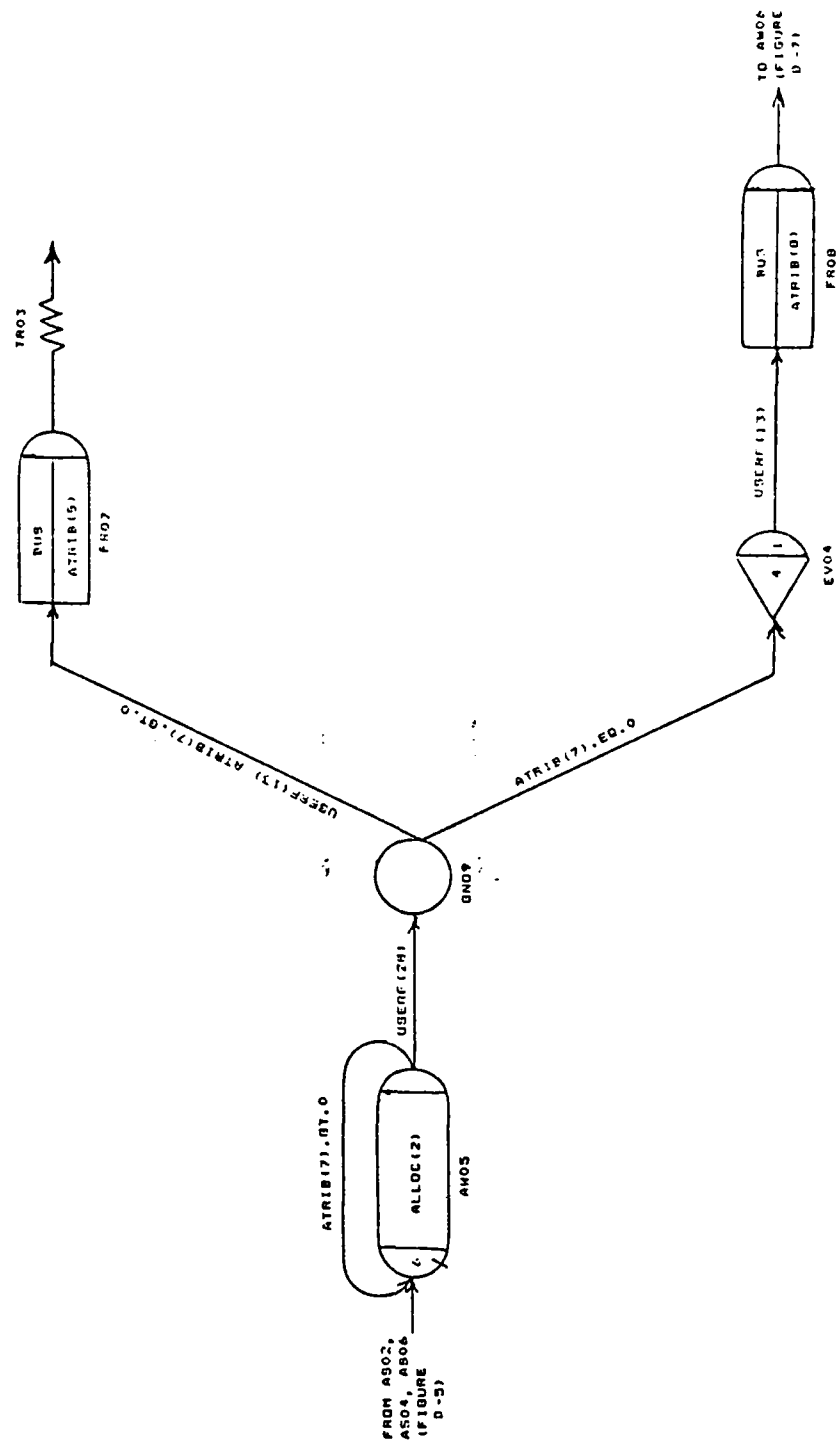
FIGURE D-6: BUS TRANSPORTATION FROM PASSENGER RECEPTION TO BILLETING
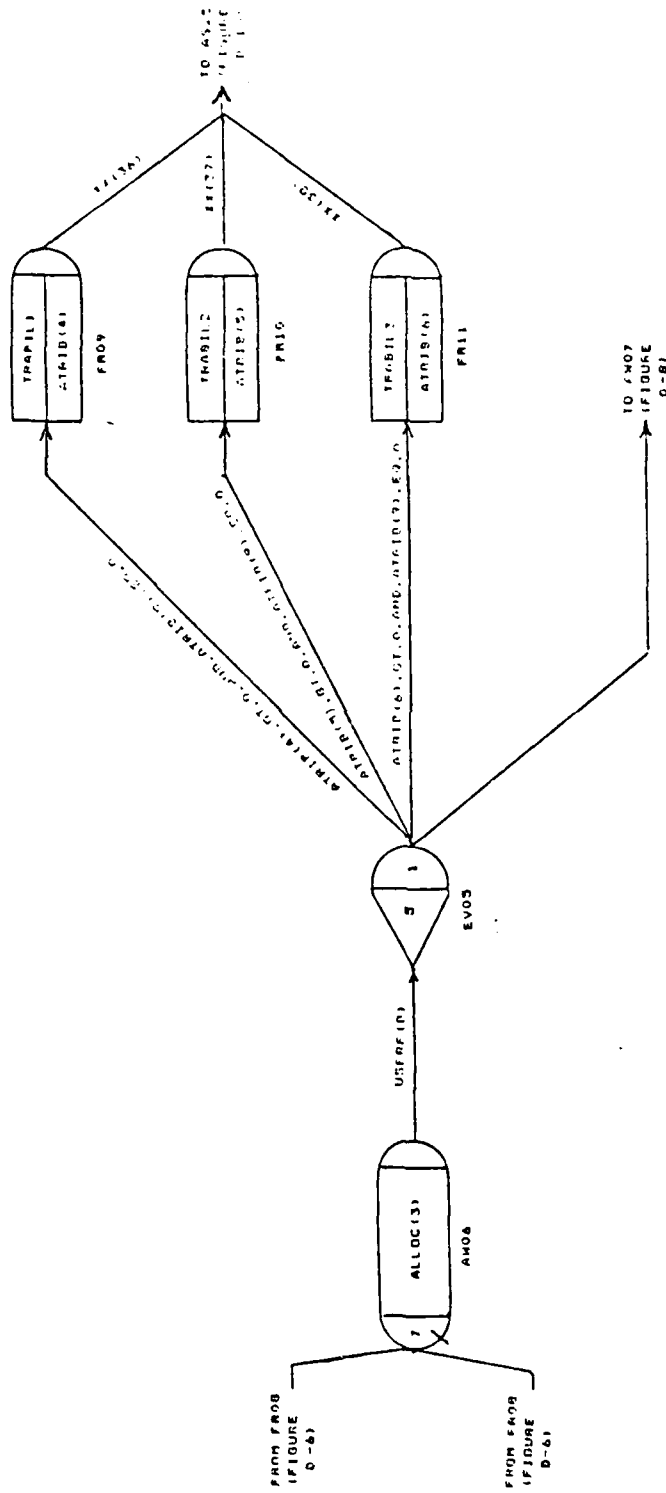
FIGURE D-7: DEPARTING BILLETING
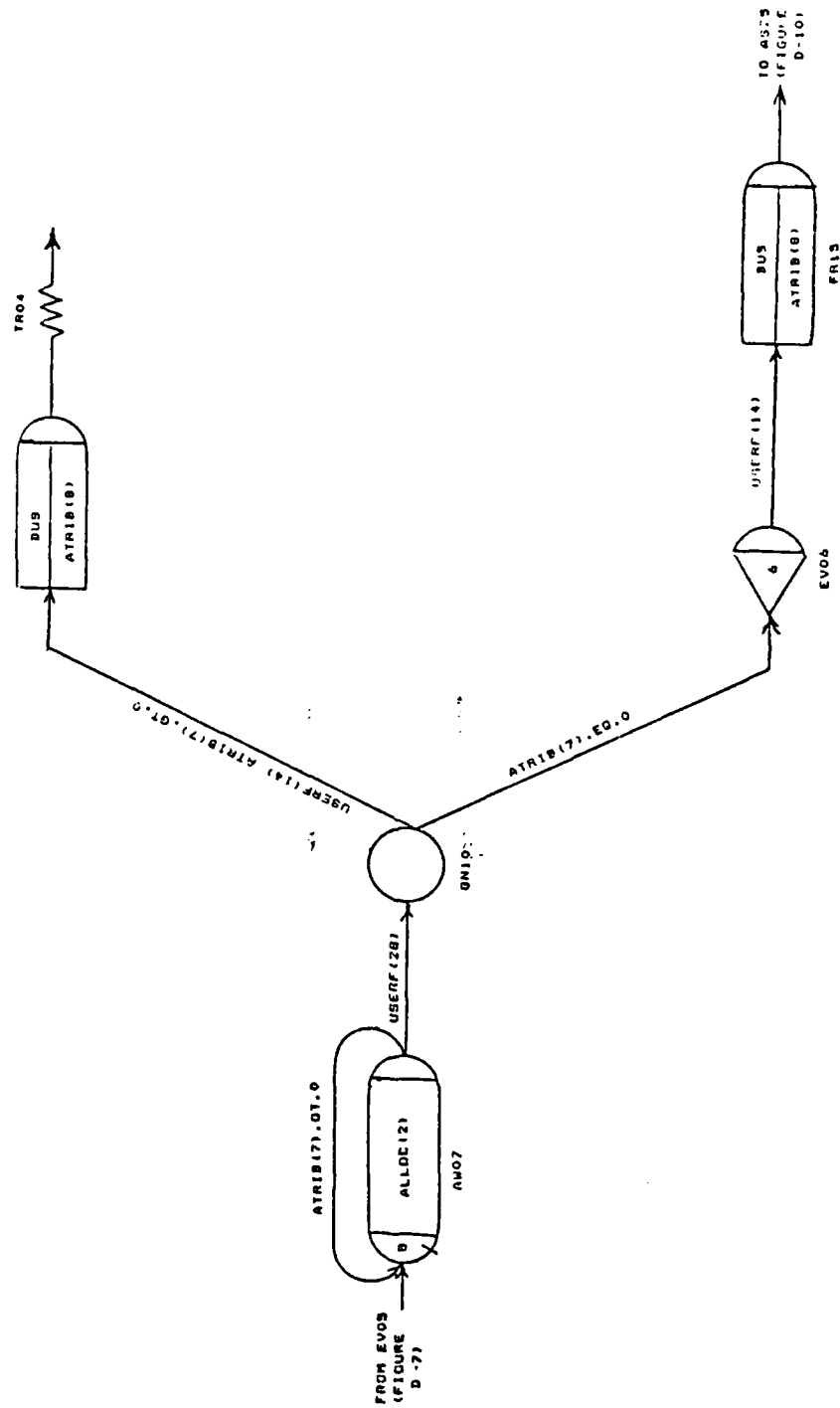
FIGURE D-8: BUS TRANSPORTATION FROM BILLETING TO STAGING
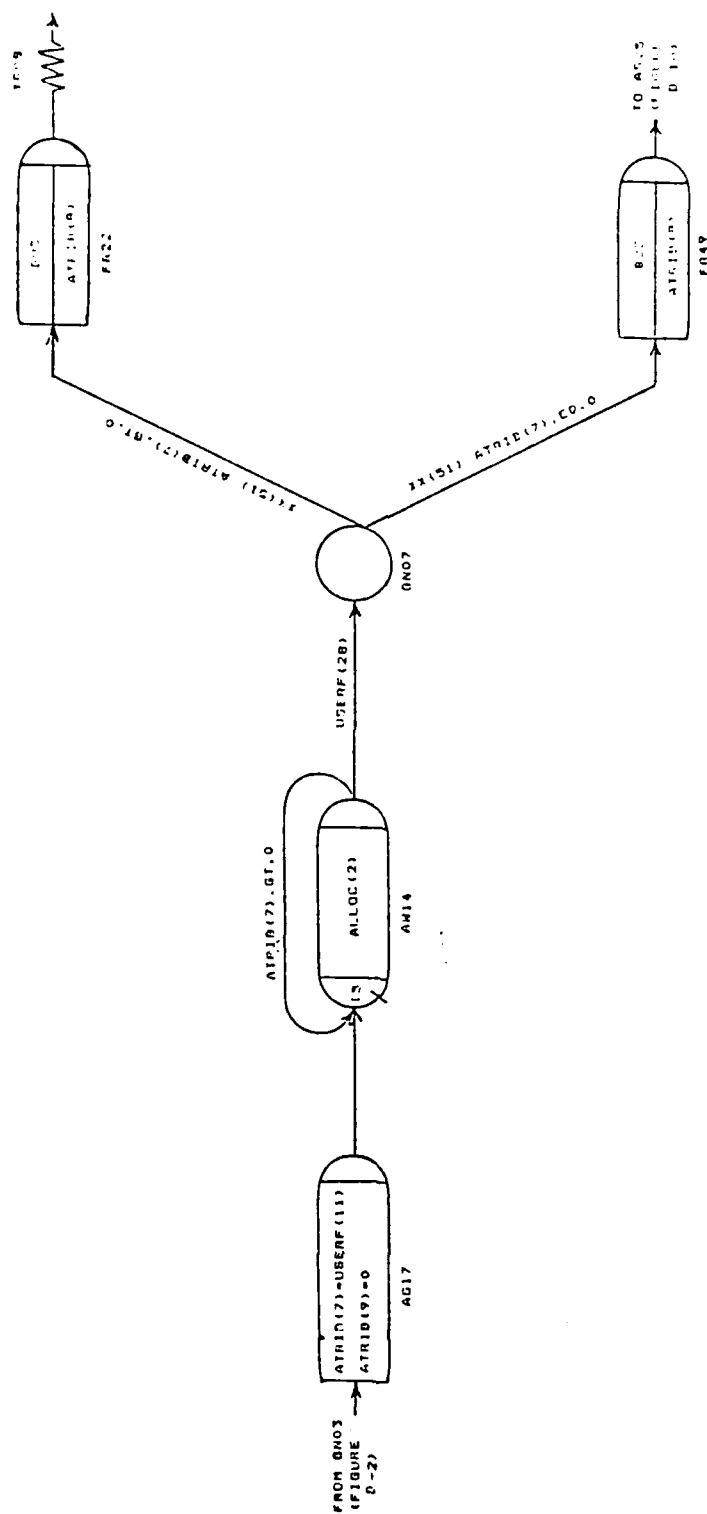
FIGURE D-9: NON-UNIT PERSONNEL BUS TRANSPORTATION TO STAGING
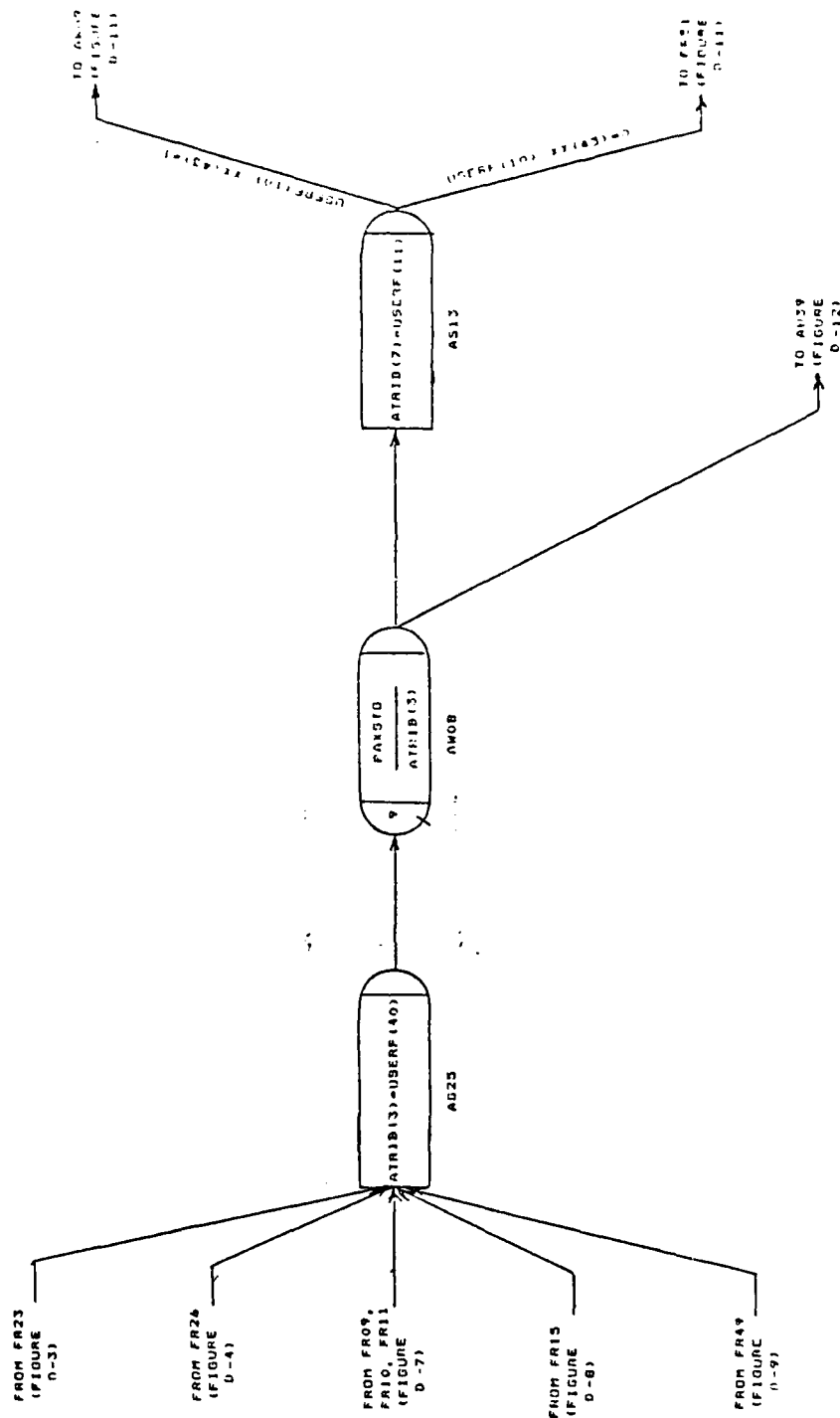
FIGURE D-10: PASSENGER STAGING

107
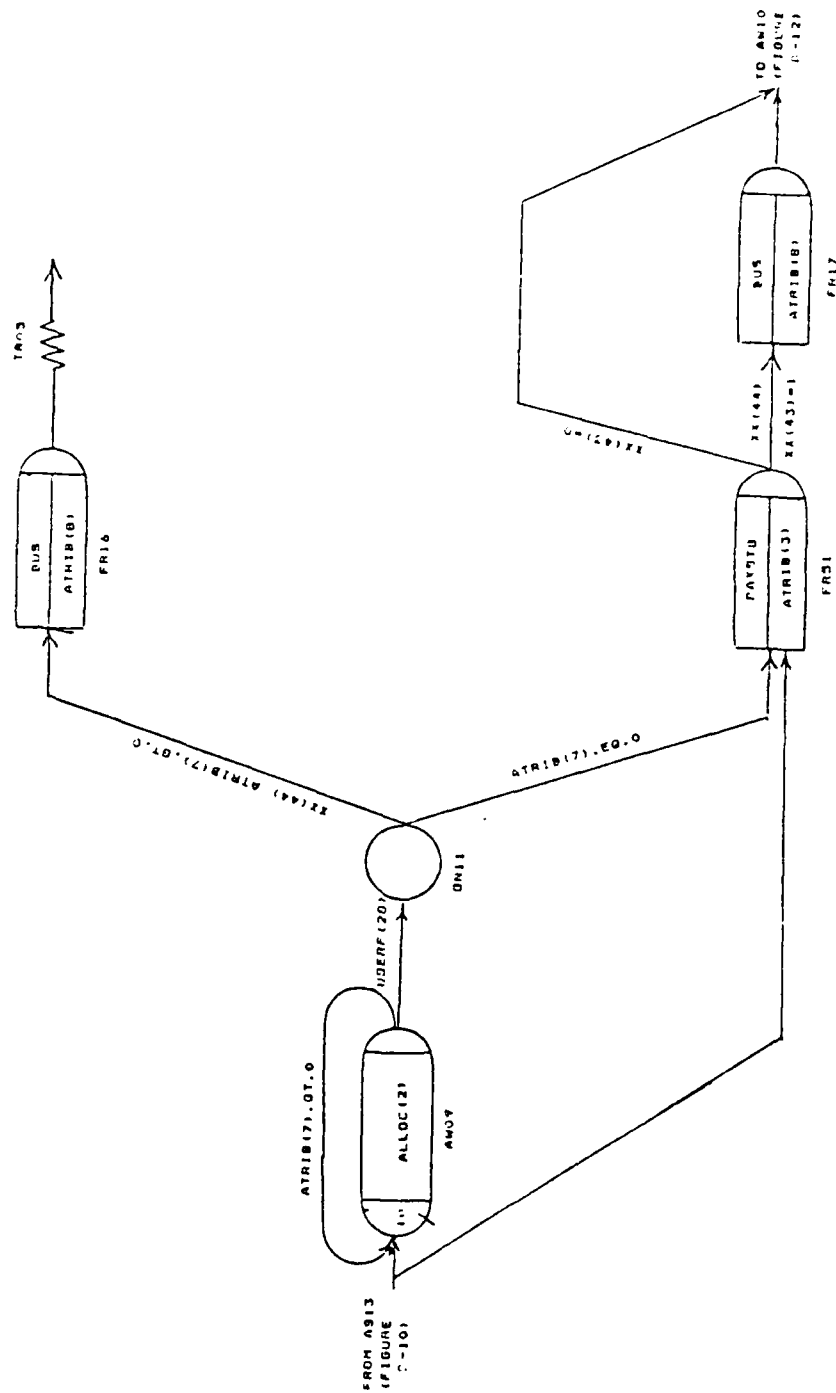
FIGURE C-11: TRANSPORTATION FROM PASSENGER STAGING TO TERMINAL
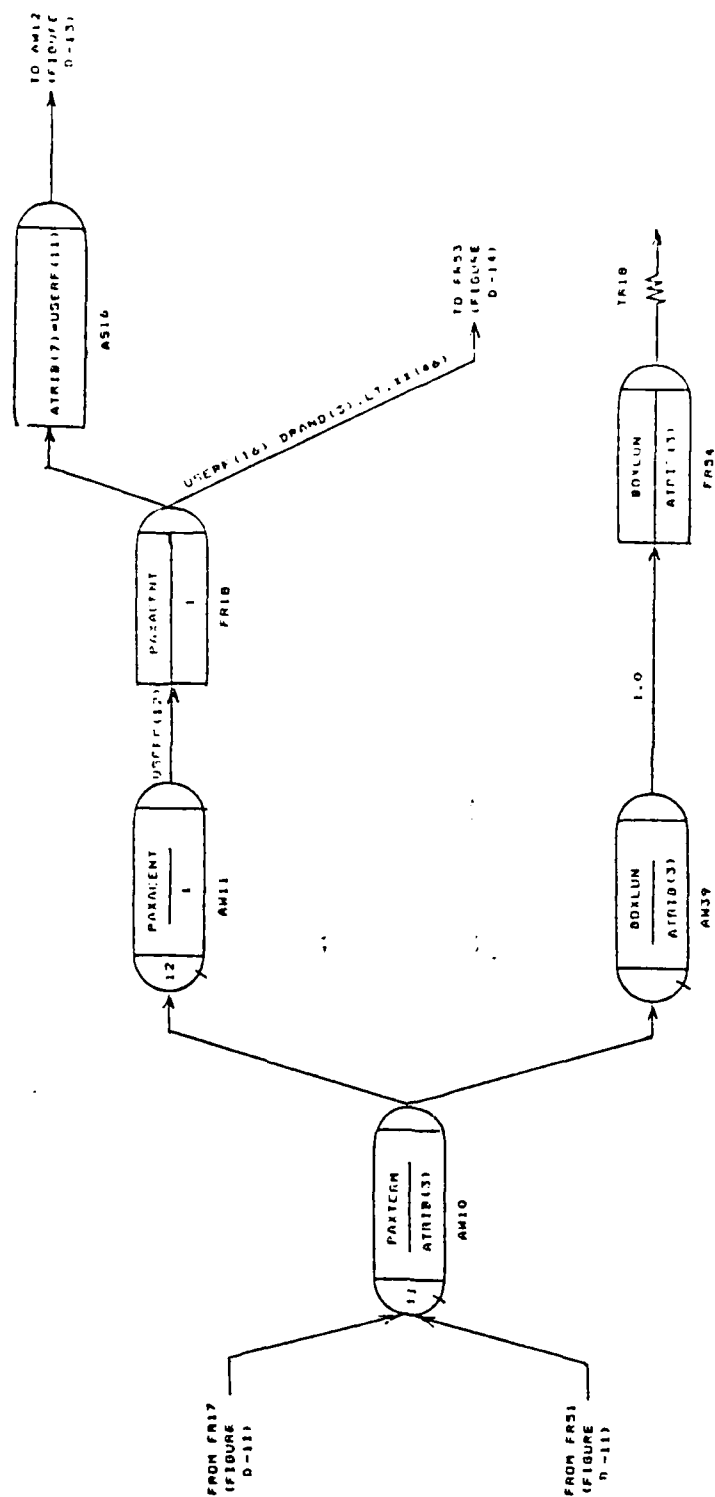
FIGURE D-12: PASSENGER TERMINAL
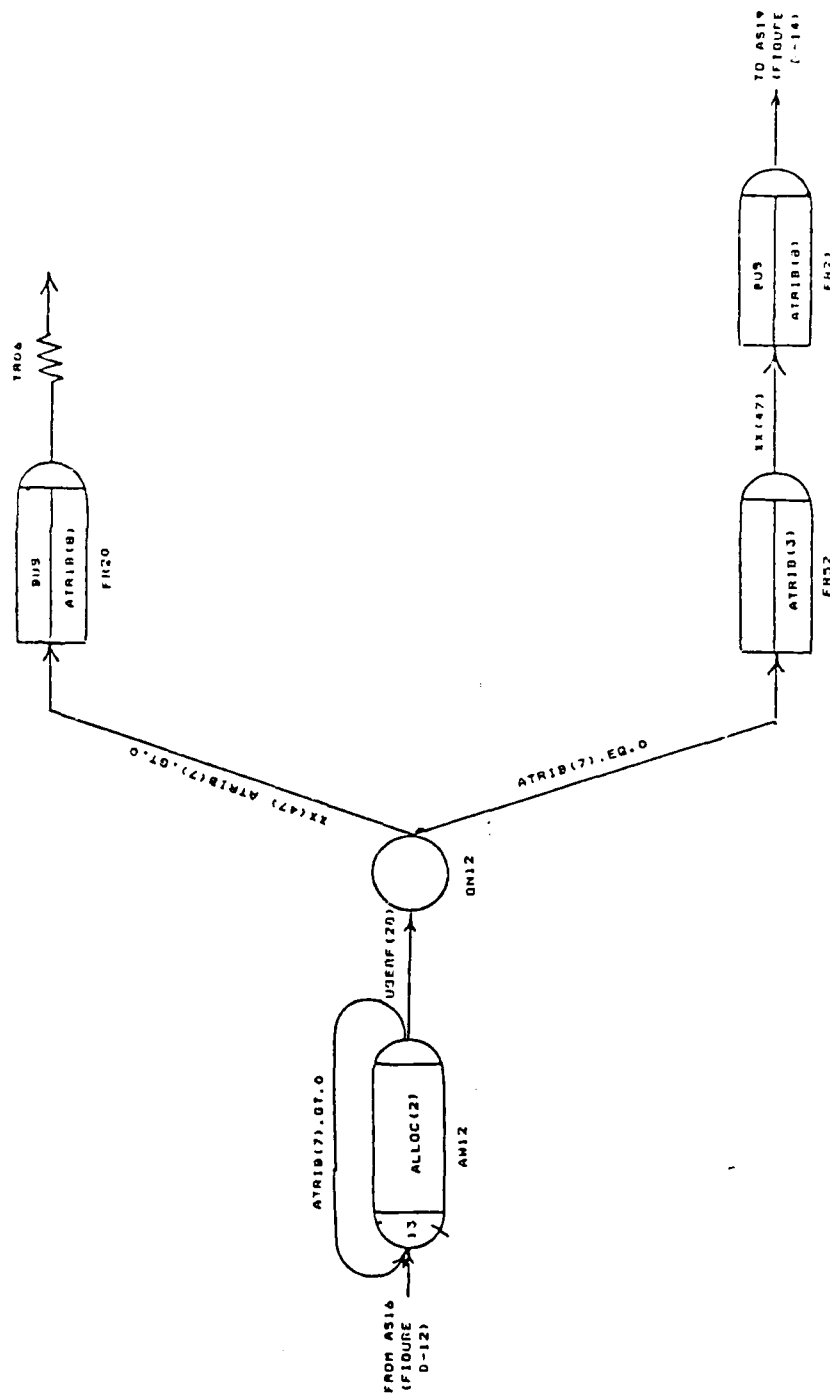
FIGURE D-13: BUS TRANSPORTATION TO AIRCRAFT
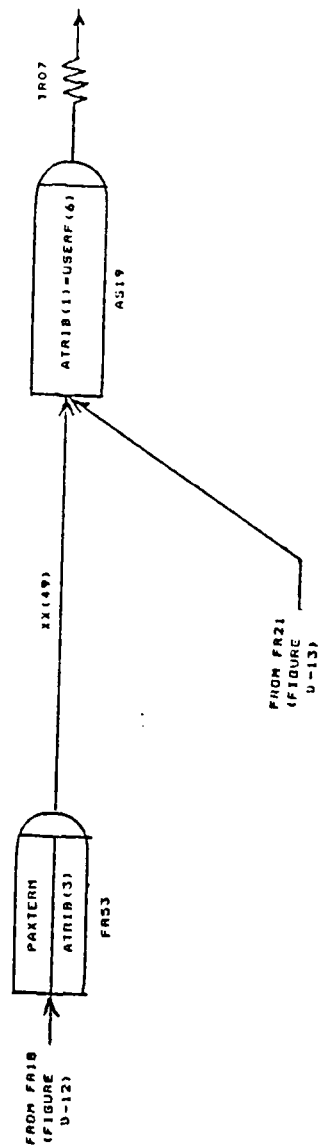
FIGURE 6-14: PASSENGER DEPARTURE

111
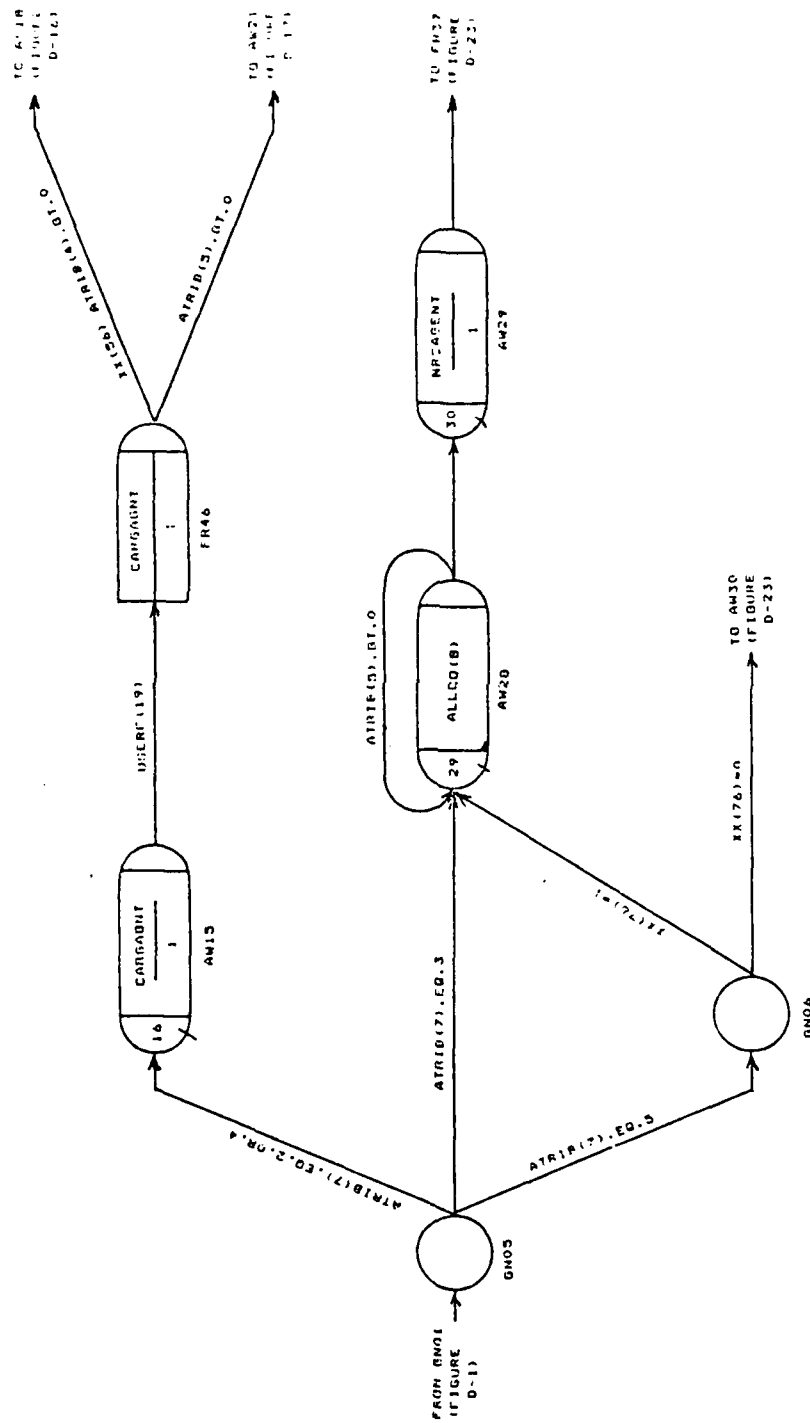
FIGURE D-15: CARGO ARRIVAL
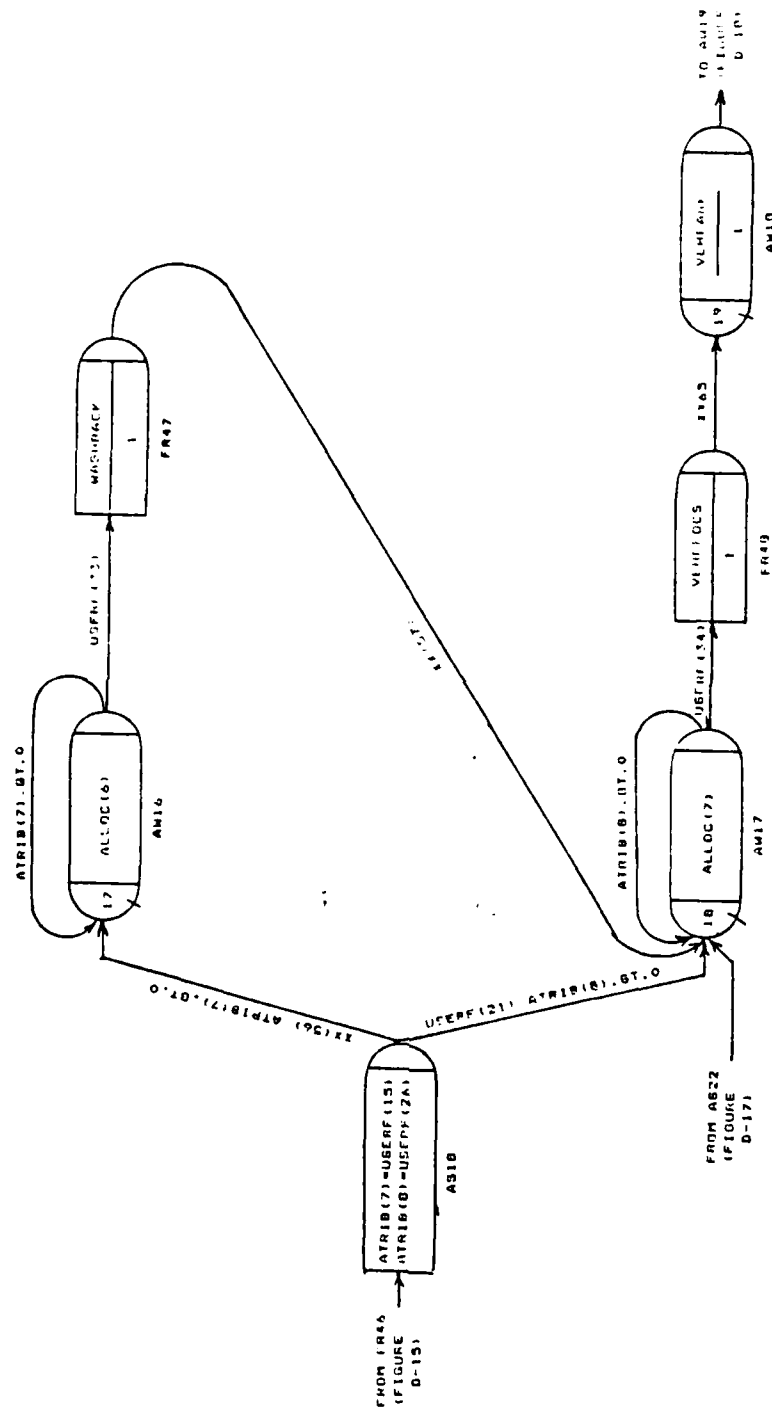
FIGURE D-16: VEHICLE WASHING AND PROCESSING

113
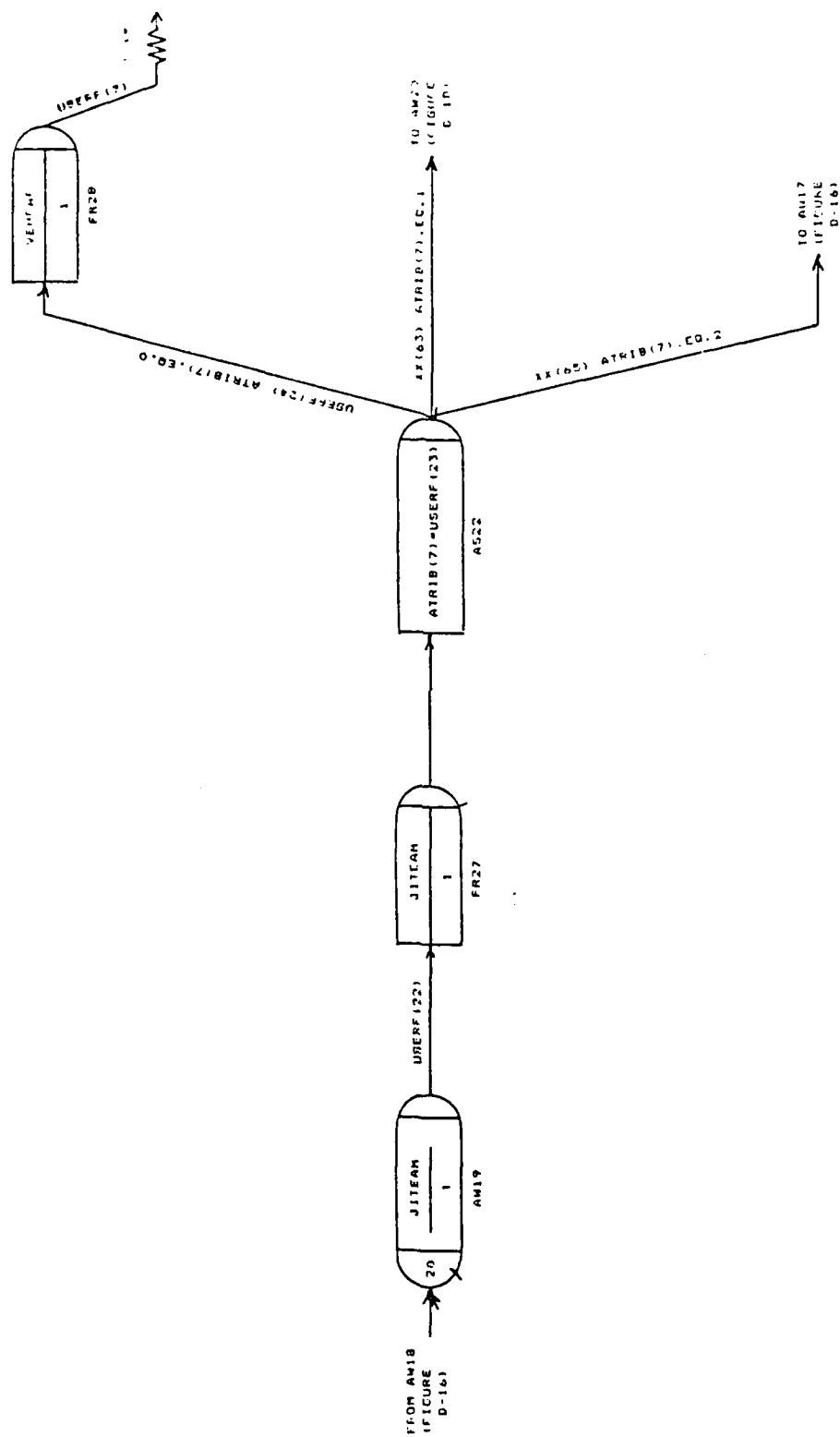
FIGURE D-17: VEHICLE INSPECTION AND DEPARTURE

114
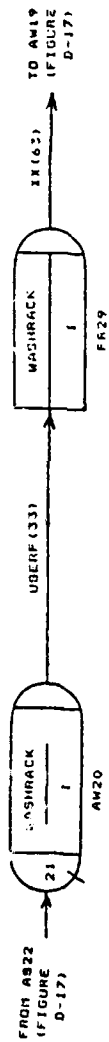
FIGURE D-13: FRUSTRATED VEHICLE REWASHING

Figure D-16. Example Program
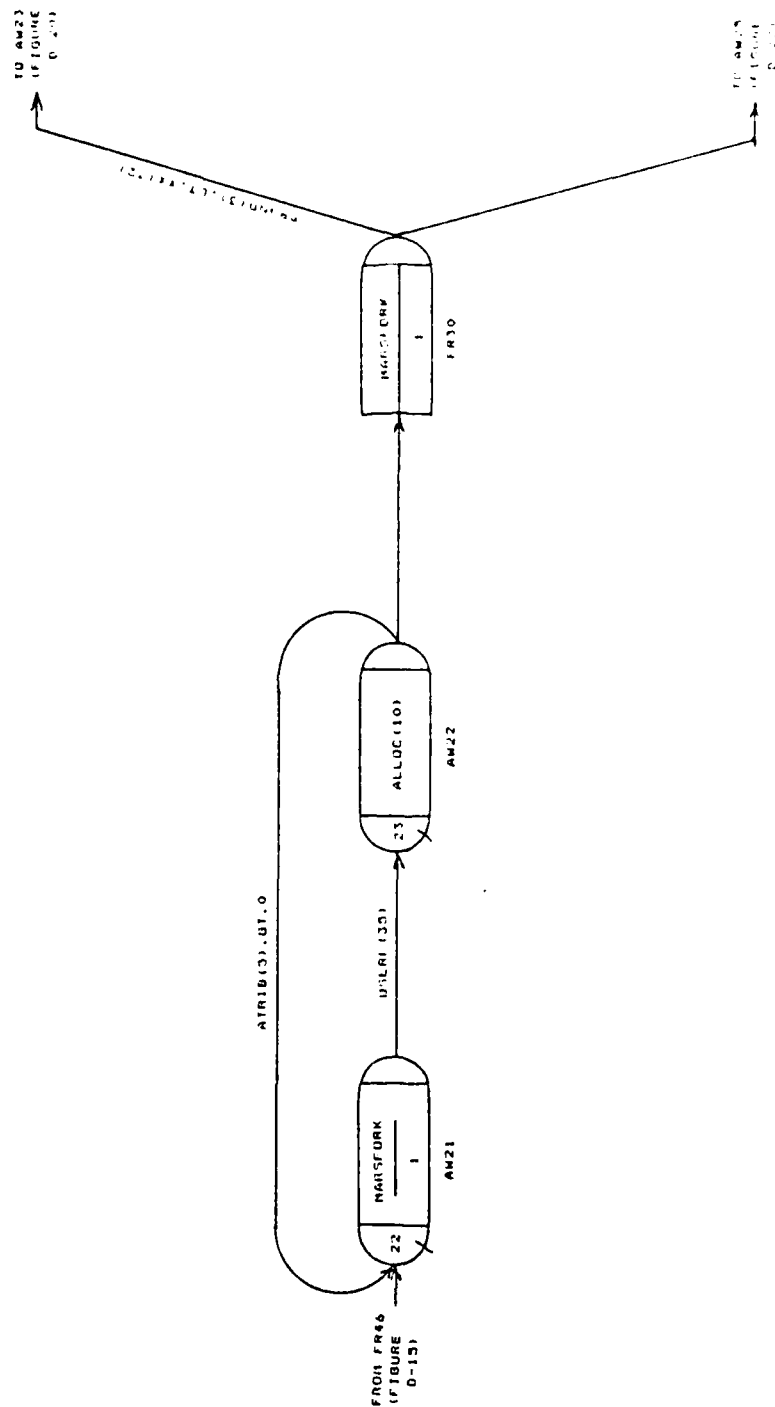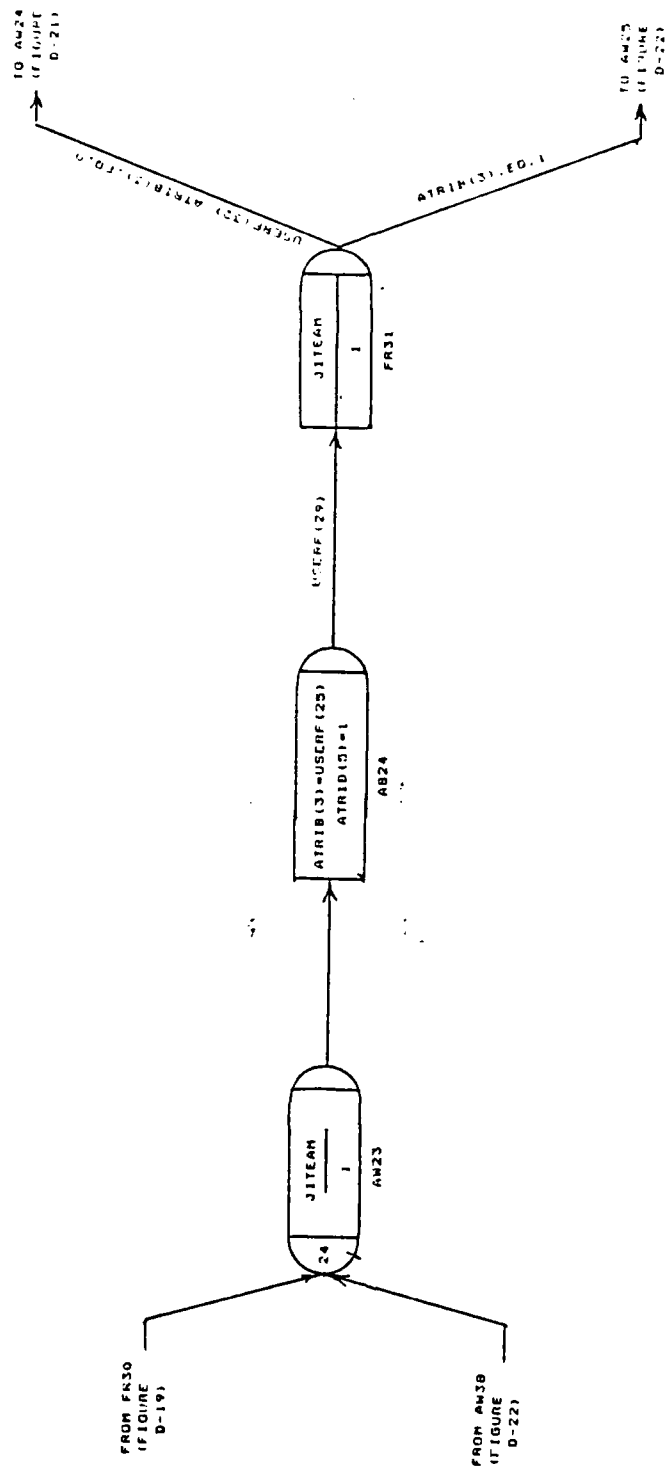
FIGURE D-20: UNIT RELATED PALLET INSPECTION

117
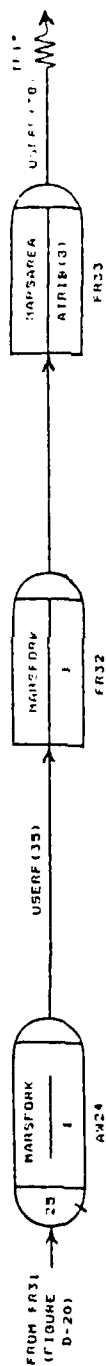
FIGURE D-21: UNIT RELATED PALLET DEPARTURE

118
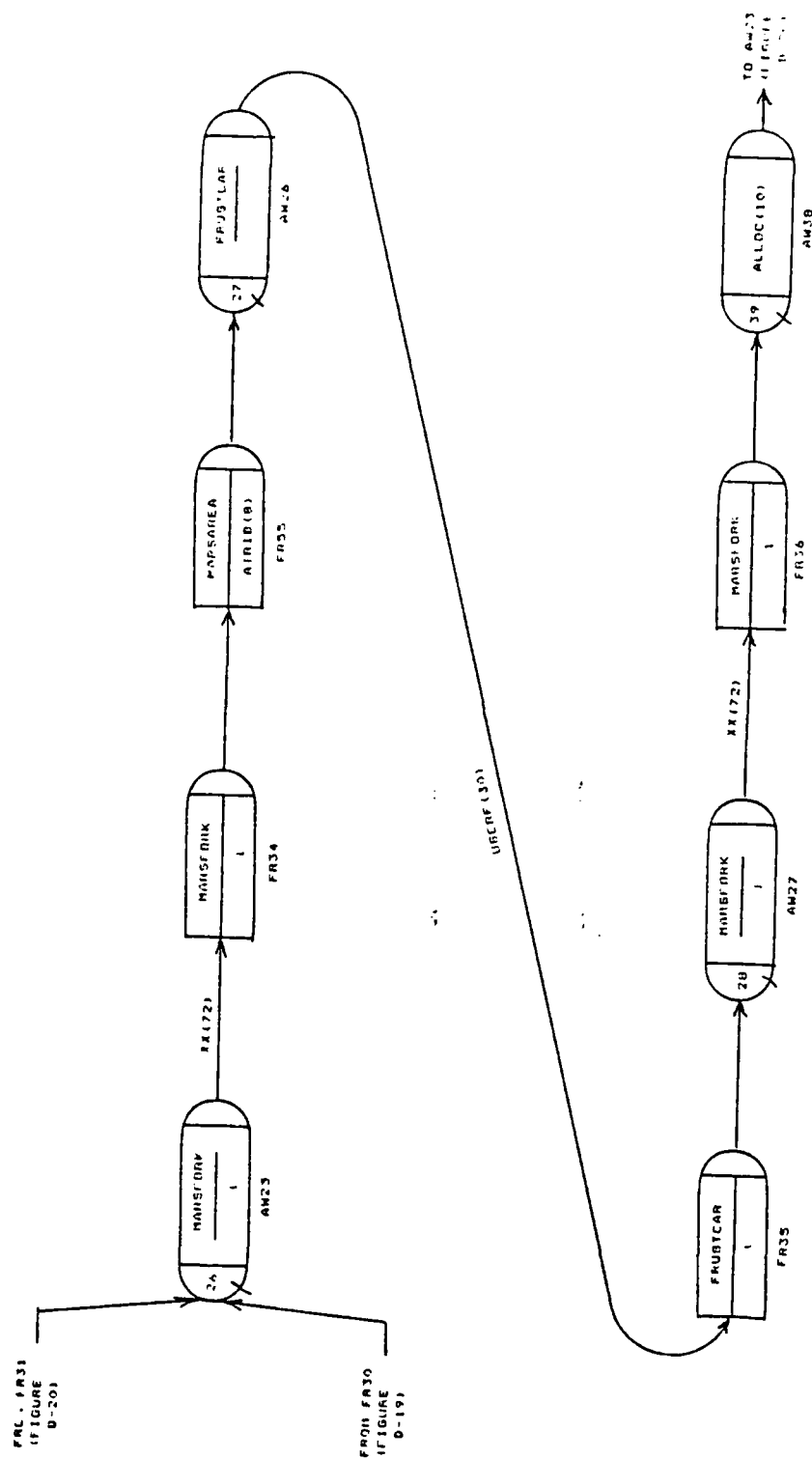
FIGURE D-22: FRUSTRATED UNIT RELATED PALLETS

119
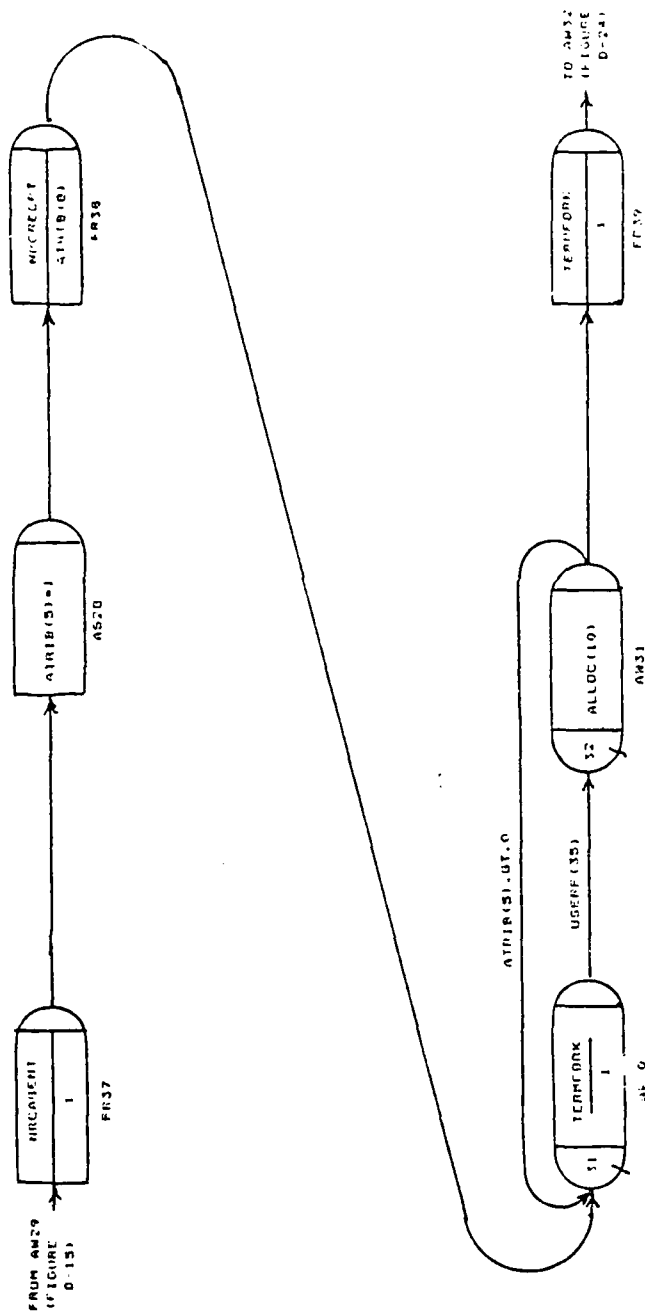
FIGURE D-22: NON-UNIT RELATED CARGO OFFLOADING
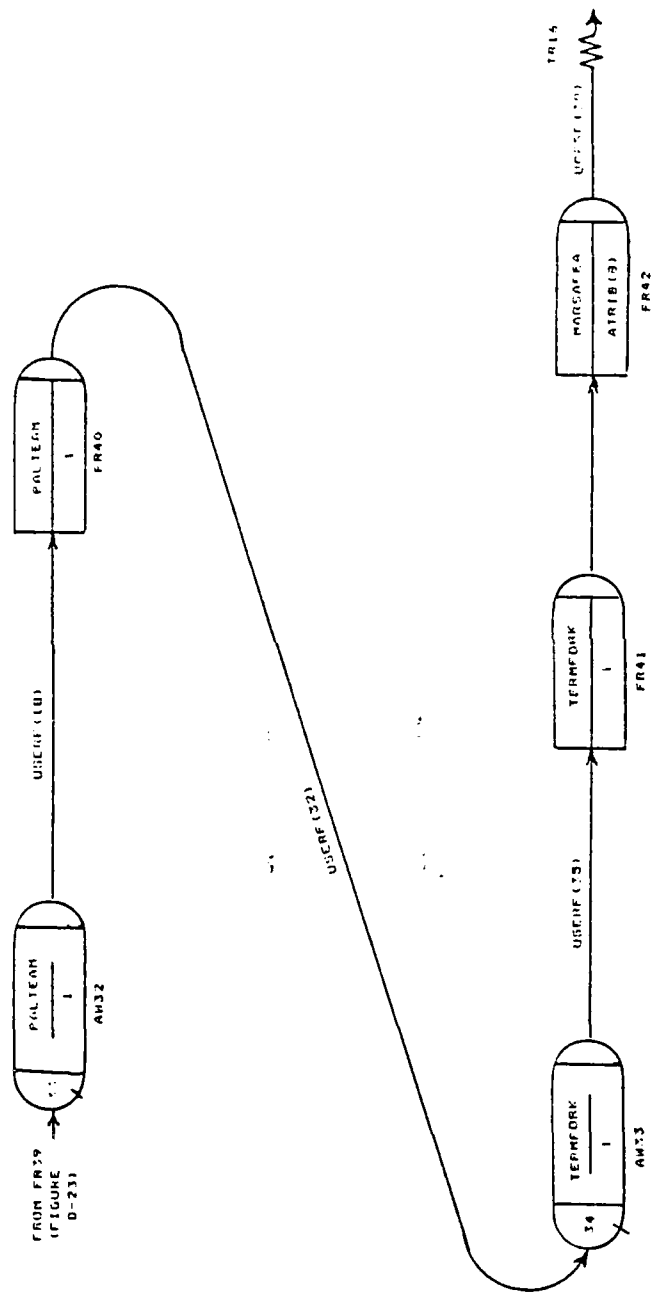
FIGURE D-24: NON-UNIT RELATED CARGO PALLETIZATION AND DEPARTURE
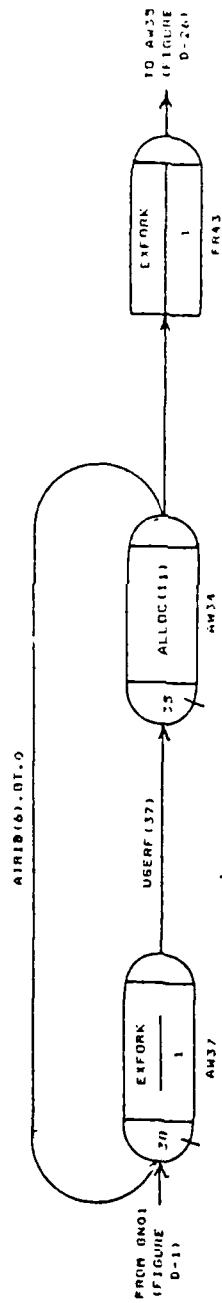
FIGURE D-25: EXPLOSIVES UNLOADING

122
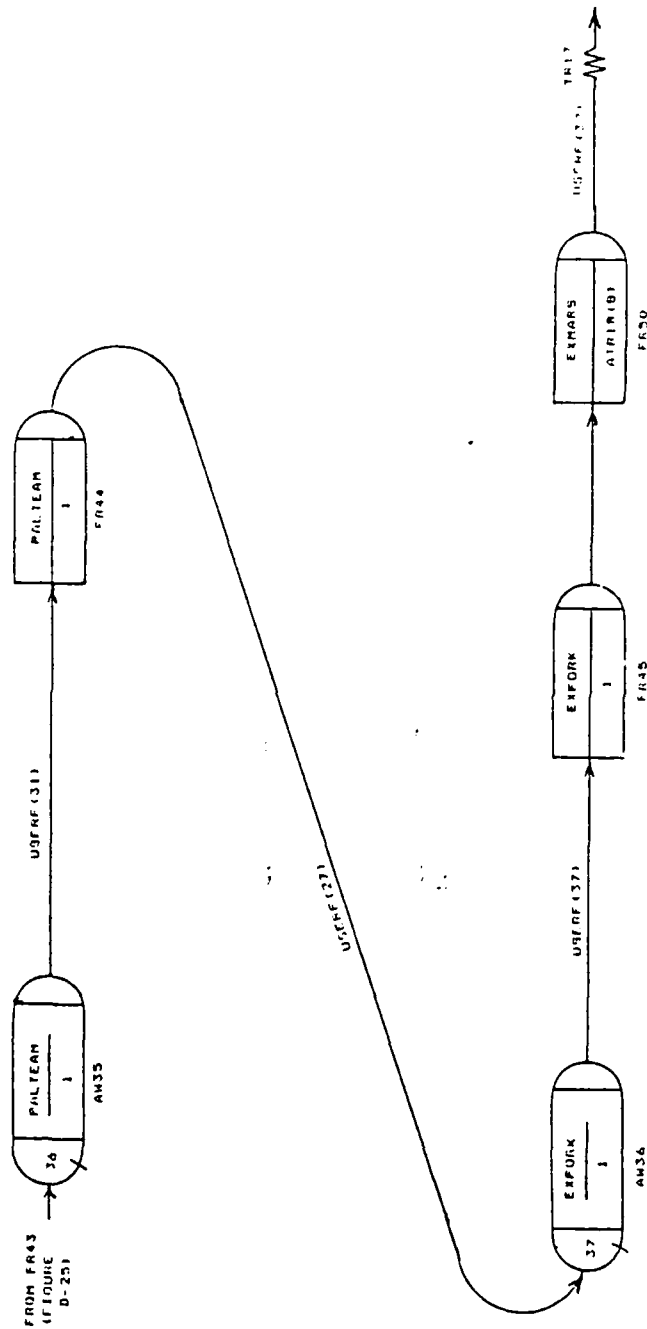
FIGURE D-26: EXPLOSIVES PALLETIZATION AND DEPARTURE

APPENDIX E

COMPUTER CODE

```
100=GEN,G. L. WHITE,RECEPTION MODEL,1/7/83;
110=LIMITS,40,9,4500;
120=SEEDS,066371131(2);
130=PRIORITY/1,LVF(1)/9,LVF(2)/10,LVF(2)/11,LVF(2)/12,LVF(2)/13,LVF(2);
140=PRIORITY/14,LVF(2)/15,LVF(2)/16,LVF(2)/17,LVF(2)/18,LVF(2)/19,LVF(2);
150=PRIORITY/20,LVF(2)/21,LVF(2)/22,LVF(2)/23,LVF(2)/24,LVF(2)/25,LVF(2);
160=PRIORITY/26,LVF(2)/27,LVF(2)/28,LVF(2)/29,LVF(2)/30,LVF(2)/31,LVF(2);
170=PRIORITY/32,LVF(2)/33,LVF(2)/34,LVF(2)/35,LVF(2)/36,LVF(2)/37,LVF(2);
180=PRIORITY/38,LVF(2)/39,LVF(2)/40,LVF(2);
190=NETWORK;
```

200=	RESOURCE/NODEPBIL(1376),2;	RESOURCE #1
210=;		ESSENTIAL
220=	RESOURCE/RECPOINT(2000),3;	RESOURCE #2
230=;		ESSENTIAL
240=	RESOURCE/INCHECKR(3),4;	RESOURCE #3
250=;		ESSENTIAL
260=	RESOURCE/BUS(3),13,10,8,6,15,14;	RESOURCE #4
270=;		ESSENTIAL
280=	RESOURCE/PAXSTG(500),9;	RESOURCE #5
290=;		ESSENTIAL
300=	RESOURCE/BOXLUN(500),40;	RESOURCE #6
310=;		ESSENTIAL
320=	RESOURCE/BILFEED1(1000),7;	RESOURCE #7
330=;		NONESSENTIAL
340=	RESOURCE/BILFEED2(1000),7;	RESOURCE #8
350=;		NONESSENTIAL
360=	RESOURCE/BILFEED3(1000),7;	RESOURCE #9
370=;		NONESSENTIAL
380=	RESOURCE/TRABIL1(491),5;	RESOURCE #10
390=;		ESSENTIAL
400=	RESOURCE/TRABIL2(227),5;	RESOURCE #11
410=;		ESSENTIAL
420=	RESOURCE/TRABIL3(705),5;	RESOURCE #12
430=;		ESSENTIAL
440=	RESOURCE/PAXTERM(500),11;	RESOURCE #13
450=;		ESSENTIAL
460=	RESOURCE/PAXAGENT(3),12;	RESOURCE #14
470=;		ESSENTIAL
480=	RESOURCE/CARGAGNT(3),16;	RESOURCE #15
490=;		ESSENTIAL
500=	RESOURCE/WASHRACK(2),21,17;	RESOURCE #16
510=;		ESSENTIAL
520=	RESOURCE/VEHPROCS(5),18;	RESOURCE #17
530=;		ESSENTIAL
540=	RESOURCE/VEHPARK(2000),19;	RESOURCE #18
550=;		ESSENTIAL
560=	RESOURCE/JITEAM(4),20,24;	RESOURCE #19
570=;		ESSENTIAL
580=	RESOURCE/MARSAREA(2000),23,32,39;	RESOURCE #20

```
590=;                              .                    NONESSENTIAL
600=     RESOURCE/PALTEAM(14),36,33;         RESOURCE #21
610=;                                        ESSENTIAL
620=     RESOURCE/EXFORK(6),37,38;           RESOURCE #22
630=;                                        ESSENTIAL
640=     RESOURCE/EXMARS(2000),35;           RESOURCE #23
650=;                                        ESSENTIAL
660=     RESOURCE/FRUSTCAR(2000),27;         RESOURCE #24
670=;                                        ESSENTIAL
680=     RESOURCE/MARSFORK(6),26,28,25,22;   RESOURCE #25
690=;                                        ESSENTIAL
700=     RESOURCE/NRCRECPT(2000),29;         RESOURCE #26
710=;                                        ESSENTIAL
720=     RESOURCE/NRCAGENT(6),30;            RESOURCE #27
730=;                                        ESSENTIAL
740=     RESOURCE/TERMFORK(6),34,31;         RESOURCE #28
750=;                                        ESSENTIAL
760=;
770=CR01 CREAT;
780=EV01 EVENT,1;
790=EV02 EVENT,2;
800=     ACT,,NNQ(1).GE.1,EV03;
810=     ACT,ATRIB(1),,GN01;
820=EV03 EVENT,3;
830=     ACT,ATRIB(1),,EV02;
840=GN01 GOON;
850=     ACT,,ATRIB(3).GT.0,AS20;
860=     ACT,,ATRIB(4).GT.0.OR.ATRIB(5).GT.0,GN05;
870=     ACT,XX(31),ATRIB(6).GT.0,AW37;
880=;
890=;     PASSENGER SUBNETWORK
900=AS20 ASSIGN,ATRIB(4)=0,ATRIB(5)=0,ATRIB(6)=0;
910=     ACT,,ATRIB(7).EQ.1,AW01;
920=     ACT,,ATRIB(7).EQ.2.OR.ATRIB(7).EQ.3,AW02;
930=     ACT,,ATRIB(7).EQ.4.OR.ATRIB(7).EQ.5,GN03;
940=;
950=;     NONDEPLOYING PERSONNEL
960=AW01 AWAIT(2),NODEPBIL/ATRIB(3);
970=TR01 TERM;
980=;
990=;     OFFBASE DEPLOYING PERSONNEL
1000=AW02 AWAIT(3),RECPOINT/ATRIB(3);
1010=AW03 AWAIT(4),INCHECKR/1;
1020=     ACT,USERF(1);
1030=FR01 FREE,INCHECKR/1;
1040=AS01 ASSIGN,ATRIB(1)=USERF(2),ATRIB(7)=USERF(11),ATRIB(9)=USERF( 20);
1050=     ACT,USERF(8),ATRIB(1).LE.XX(8).AND.ATRIB(9).EQ.0,FR23;
1060=     ACT,USERF(8),ATRIB(1).LE.XX(8).AND.ATRIB(9).EQ.1,AW13;
1070=     ACT,,ATRIB(1).GT.XX(8),AW04;
1080=;
1090=;     BRANCH IF THEY HAVE OWN TRANSPORT
1100=FR23 FREE,RECPOINT/ATRIB(3);
```

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```
1110=      ACT,XX(42),,AS25;
1120=;
1130=;      BRANCH IF RIDING BUS TO PAX STAGING
1140=AW13  AWAIT(14),ALLOC(2);
1150=      ACT,USERF(28),,GN08;
1160=      ACT,,ATRIB(7).GT.0,AW13;
1170=GN08  GOON;
1180=      ACT,XX(42),ATRIB(7).GT.0,FR24;
1190=      ACT,,ATRIB(7).EQ.0,FR25;
1200=FR24  FREE,BUS/ATRIB(8);
1210=TR02  TERM;
1220=FR25  FREE,RECPOINT/ATRIB(3);
1230=      ACT,XX(42);
1240=FR26  FREE,BUS/ATRIB(8);
1250=      ACT,,,AS25;
1260=;
1270=;      BRANCH INTO TRANSIENT BILLETING
1280=AW04  AWAIT(5),ALLOC(1);
1290=      ACT,,ATRIB(1).LE.XX(8),AS01;
1300=      ACT,,ATRIB(1).GT.XX(8),GN04;
1310=GN04  GOON;
1320=      ACT,,ATRIB(4).GT.0.AND.ATRIB(9).EQ.0,FR02;
1330=      ACT,,ATRIB(5).GT.0.AND.ATRIB(9).EQ.0,FR03;
1340=      ACT,,ATRIB(6).GT.0.AND.ATRIB(9).EQ.0,FR04;
1350=      ACT,,ATRIB(4).GT.0.AND.ATRIB(9).EQ.1,AS03;
1360=      ACT,,ATRIB(5).GT.0.AND.ATRIB(9).EQ.1,AS05;
1370=      ACT,,ATRIB(6).GT.0.AND.ATRIB(9).EQ.1,AS07;
1380=;
1390=;      MOVE TO BILLETING AREA(S) BY OWN TRANSPORTATION.
1400=;      AREA 1
1410=FR02  FREE,RECPOINT/ATRIB(4);
1420=AS02  ASSIGN,ATRIB(5)=0,ATRIB(6)=0;
1430=      ACT,XX(26),,AW06;
1440=;      AREA 2
1450=FR03  FREE,RECPOINT/ATRIB(5);
1460=AS04  ASSIGN,ATRIB(4)=0,ATRIB(6)=0;
1470=      ACT,XX(27),,AW06;
1480=;      AREA 3
1490=FR04  FREE,RECPOINT/ATRIB(6);
1500=AS06  ASSIGN,ATRIB(4)=0,ATRIB(5)=0;
1510=      ACT,XX(28),,AW06;
1520=;      AREA 1
1530=AS03  ASSIGN,ATRIB(5)=0,ATRIB(6)=0,
1540=          ATRIB(7)=USERF(3);
1550=      ACT,,,AW05;
1560=;      AREA 2
1570=AS05  ASSIGN,ATRIB(4)=0,ATRIB(6)=0,
1580=          ATRIB(7)=USERF(4);
1590=      ACT,,,AW05;
1600=;      AREA 3
1610=AS07  ASSIGN,ATRIB(4)=0,ATRIB(5)=0,
1620=          ATRIB(7)=USERF(5);
```

```
1630=      ACT,,,AW05;
1640=;
1650=AW05  AWAIT(6),ALLOC(2);
1660=      ACT,USERF(28),,GN09;
1670=      ACT,,ATRIB(7).GT.0,AW05;
1680=GN09  GOON;
1690=      ACT,USERF(13),ATRIB(7).GT.0,FR07;
1700=      ACT,,ATRIB(7).EQ.0,EV04;
1710=FR07  FREE,BUS/ATRIB(8);
1720=TR03  TERM;
1730=;
1740=EV04  EVENT,4;
1750=      ACT,USERF(13);
1760=FR08  FREE,BUS/ATRIB(8);
1770=;
1780=;    NOW IN THE BILLETING AREA(S), ALLOCATE FEEDING
1790=AW06  AWAIT(7),ALLOC(3);
1800=      ACT,USERF(8);
1810=EV05  EVENT,5,1;
1820=;
1830=;    READY TO LEAVE BILLETING AREA(S) BY OWN TRANSPORT
1840=      ACT,,ATRIB(4).GT.0.AND.ATRIB(9).EQ.0,FR09;
1850=      ACT,,ATRIB(5).GT.0.AND.ATRIB(9).EQ.0,FR10;
1860=      ACT,,ATRIB(6).GT.0.AND.ATRIB(9).EQ.0,FR11;
1870=;    THEN IF BY BUS
1880=      ACT,,,AW07;
1890=;
1900=;    OWN TRANSPORTATION THROUGH THESE NODES
1910=FR09  FREE,TRABIL1/ATRIB(4);
1920=      ACT,XX(36),,AS25;
1930=FR10  FREE,TRABIL2/ATRIB(5);
1940=      ACT,XX(37),,AS25;
1950=FR11  FREE,TRABIL3/ATRIB(6);
1960=      ACT,XX(38),,AS25;
1970=;
1980=;    RIDERS MUST AWAIT BUSES
1990=AW07  AWAIT(8),ALLOC(2);
2000=      ACT,USERF(28),,GN10;
2010=      ACT,,ATRIB(7).GT.0,AW07;
2020=GN10  GOON;
2030=      ACT,USERF(14),ATRIB(7).GT.0,FR14;
2040=      ACT,,ATRIB(7).EQ.0,EV06;
2050=FR14  FREE,BUS/ATRIB(8);
2060=TR04  TERM;
2070=;
2080=EV06  EVENT,6;
2090=      ACT,USERF(14);
2100=FR15  FREE,BUS/ATRIB(8);
2110=;
2120=;    PASSENGER STAGING AREA
2130=AS25  ASSIGN,ATRIB(3)=USERF(40);
2140=AW08  AWAIT(9),PAXSTG/ATRIB(3);
```

```
2150=      ACT,USERF(9);
2160=      ACT,,,AW39;
2170=AS13   ASSIGN,ATRIB(7)=USERF(11);
2180=      ACT,USERF(10),XX(43).EQ.1,AW09;
2190=      ACT,USERF(10),XX(43).EQ.0,FR51;
2200=;
2210=;     LEAVING PAS STAGING- FIRST BY FOOT
2220=FR51  FREE,PAXSTG/ATRIB(3);
2230=      ACT,XX(44),XX(43).EQ.0,AW10;
2240=      ACT,XX(44),XX(43).EQ.1,FR17;
2250=;
2260=;     THEN BY BUS
2270=AW09  AWAIT(10),ALLOC(2);
2280=      ACT,USERF(28),,GN11;
2290=      ACT,,ATRIB(7).GT.0,AW09;
2300=GN11  GOON;
2310=      ACT,XX(44),ATRIB(7).GT.0,FR16;
2320=      ACT,,ATRIB(7).EQ.0,FR51;
2330=FR16  FREE,BUS/ATRIB(8);
2340=TR05  TERM;
2350=FR17  FREE,BUS/ATRIB(8);
2360=;
2370=;     PASSENGER TERMINAL
2380=AW10  AWAIT(11),PAXTERM/ATRIB(3);
2390=      ACT,,,AW11;
2400=      ACT,,,AW39;
2410=AW39  AWAIT(40),BOXLUN/ATRIB(3);
2420=      ACT,1.0;
2430=FR54  FREE,BOXLUN/ATRIB(3);
2440=TR18  TERM;
2450=AW11  AWAIT(12),PAXAGENT/1;
2460=      ACT,USERF(12);
2470=FR18  FREE,PAXAGENT/1,1;
2480=      ACT,USERF(16),DRAND(3).LT.XX(46),FR53;
2490=      ACT,,,AS16;
2500=;
2510=;     SOME WILL WALK TO THE AIRCRAFT
2520=FR53  FREE,PAXTERM/ATRIB(3);
2530=      ACT,XX(49),;
2540=AS19  ASSIGN,ATRIB(1)=USERF(6);
2550=TR07  TERM;
2560=;
2570=;     SOME WILL RIDE BUSES
2580=AS16  ASSIGN,ATRIB(7)=USERF(11);
2590=      ACT,USERF(17);
2600=AW12  AWAIT(13),ALLOC(2);
2610=      ACT,USERF(28),,GN12;
2620=      ACT,,ATRIB(7).GT.0,AW12;
2630=GN12  GOON;
2640=      ACT,XX(47),ATRIB(7).GT.0,FR20;
2650=      ACT,,ATRIB(7).EQ.0,FR52;
2660=FR20  FREE,BUS/ATRIB(8);
```

```
2670=TR05  TERM;
2680=;
2690=FR52  FREE,PAXTERM/ATRIB(3);
2700=      ACT,XX(47);
2710=FR21  FREE,BUS/ATRIB(8);
2720=;
2730=;     STATISTICS ARE COLLECTED
2740=      ACT,,,AS19;
2750=;
2760=;     ON BASE DEPLOYING PERSONNEL
2770=GN03  GOON;
2780=      ACT,USERF(8),XX(50).EQ.0,AS25;
2790=;
2800=;     IF NEED BUS TRANSPORT TO PAX STAGING
2810=      ACT,USERF(8),XX(50).EQ.1,AS17;
2820=AS17  ASSIGN,ATRIB(7)=USERF(11);
2830=AW14  AWAIT(15),ALLOC(2);
2840=      ACT,USERF(28),,GN07;
2850=      ACT,,ATRIB(7).GT.0,AW14;
2860=GN07  GOON;
2870=      ACT,XX(51),ATRIB(7).GT.0,FR22;
2880=      ACT,XX(51),ATRIB(7).EQ.0,FR49;
2890=FR22  FREE,BUS/ATRIB(8);
2900=TR08  TERM;
2910=FR49  FREE,BUS/ATRIB(8);
2920=      ACT,,,AS25;
2930=;
2940=;     CARGO SUBNETWORK
2950=;
2960=GN05  GOON;
2970=      ACT,,ATRIB(7).EQ.2.OR.ATRIB(7).EQ.4,AW15;
2980=      ACT,,ATRIB(7).EQ.3,AW28;
2990=      ACT,,ATRIB(7).EQ.5,GN06;
3000=;
3010=;     URC BRANCH
3020=AW15  AWAIT(16),CARGAGNT/1;
3030=      ACT,USERF(19);
3040=FR46  FREE,CARGAGNT/1;
3050=      ACT,XX(56),ATRIB(4).GT.0,AS18;
3060=      ACT,,ATRIB(5).GT.0,AW21;
3070=;
3080=;     VEHICLE PROCESSING BRANCH
3090=AS18  ASSIGN,ATRIB(7)=USERF(15),ATRIB(8)=USERF(26);
3100=      ACT,XX(56),ATRIB(7).GT.0,AW16;
3110=      ACT,ATRIB(9),ATRIB(8).GT.0,AW17;
3120=;
3130=;     WASHRACK
3140=AW16  AWAIT(17),ALLOC(6);
3150=      ACT,,ATRIB(7).GT.0,AW16;
3160=      ACT,USERF(33);
3170=FR47  FREE,WASHRACK/1;
3180=      ACT,XX(57);
```

```
3190=;
3200=;      OTHER VEHICLE PROCESSING
3210=AW17  AWAIT(18),ALLOC(7);
3220=      ACT,,ATRIB(8).GT.0,AW17;
3230=      ACT,USERF(34);
3240=FR48  FREE,VEHPROCS/1;
3250=      ACT,XX(65);
3260=;
3270=;      PARKING LOT
3280=AW18  AWAIT(19),VEHPARK/1;
3290=;
3300=;      JOINT INSPECTION
3310=AW19  AWAIT(20),JITEAM/1;
3320=      ACT,USERF(22);
3330=FR27  FREE,JITEAM/1;
3340=AS22  ASSIGN,ATRIB(7)=USERF(23);
3350=;
3360=;      VEHICLES PASSING INSPECTION
3370=      ACT,USERF(24),ATRIB(7).EQ.0,FR28;
3380=;
3390=;      FRUSTRATED VEHICLES
3400=      ACT,XX(63),ATRIB(7).EQ.1,AW20;
3410=      ACT,XX(65),ATRIB(7).EQ.2,AW17;
3420=AW20  AWAIT(21),WASHRACK/1;
3430=      ACT,USERF(33);
3440=FR29  FREE,WASHRACK/1;
3450=      ACT,XX(63),,AW19;
3460=FR28  FREE,VEHPARK/1;
3470=      ACT,USERF(7);
3480=TR15  TERM;
3490=;
3500=;      NON-VEHICULAR CARGO BRANCH
3510=AW21  AWAIT(22),MARSFORK/1;
3520=      ACT,USERF(35);
3530=AW22  AWAIT(23),ALLOC(10);
3540=      ACT,,ATRIB(5).GT.0,AW21;
3550=      ACT,,,FR30;
3560=FR30  FREE,MARSFORK/1,1;
3570=      ACT,,DRAND(3).LE.XX(32),AW23;
3580=      ACT,,,AW25;
3590=;
3600=;      AWAIT JOINT INSPECTION
3610=AW23  AWAIT(24),JITEAM/1;
3620=AS24  ASSIGN,ATRIB(3)=USERF(25),ATRIB(5)=1;
3630=      ACT,USERF(29);
3640=FR31  FREE,JITEAM/1;
3650=;
3660=;      AFTER INSPECTION COMPLETE
3670=;      SORT PASSES FROM FAILS
3680=      ACT,,ATRIB(3).EQ.1,AW25;
3690=      ACT,USERF(32),ATRIB(3).EQ.0,AW24;
3700=;
```

```
3710=;    FRUSTRATED CARGO BRANCH
3720=AW25 AWAIT(26),MARSFORK/1;
3730=     ACT,XX(72);
3740=FR34 FREE,MARSFORK/1;
3750=FR55 FREE,MARSAREA/ATRIB(8);
3760=AW26 AWAIT(27),FRUSTCAR/1;
3770=     ACT,USERF(30);
3780=FR35 FREE,FRUSTCAR/1;
3790=AW27 AWAIT(28),MARSFORK/1;
3800=     ACT,XX(72);
3810=FR36 FREE,MARSFORK/1;
3820=AW38 AWAIT(39),ALLOC(10);
3830=     ACT,,,AW23;
3840=;
3950=;    NON-FAILED PALLETS
3860=AW24 AWAIT(25),MARSFORK/1;
3870=     ACT,USERF(35);
3880=FR32 FREE,MARSFORK/1;
3890=FR33 FREE,MARSAREA/ATRIB(8);
3900=     ACT,USERF(38),,TR15;
3910=;
3920=;    OFFBASE NRC BRANCH
3930=GN06 GOON;
3940=     ACT,,XX(76).EQ.1,AW28;
3950=     ACT,,XX(76).EQ.0,AW30;
3960=AW28 AWAIT(29),ALLOC(8);
3970=     ACT,,ATRIB(5).GT.0,AW28;
3980=     ACT,,,AW29;
3990=AW29 AWAIT(30),NRCAGENT/1;
4000=     ACT,USERF(36);
4010=FR37 FREE,NRCAGENT/1;
4020=AS28 ASSIGN,ATRIB(5)=1;
4030=FR38 FREE,NRCRECPT/ATRIB(8);
4040=AW30 AWAIT(31),TERMFORK/1;
4050=     ACT,USERF(35);
4060=AW31 AWAIT(32),ALLOC(10);
4070=     ACT,,ATRIB(5).GT.0,AW30;
4080=     ACT,,,FR39;
4090=FR39 FREE,TERMFORK/1;
4100=AW32 AWAIT(33),PALTEAM/1;
4110=     ACT,USERF(18);
4120=FR40 FREE,PALTEAM/1;
4130=     ACT,USERF(32);
4140=AW33 AWAIT(34),TERMFORK/1;
4150=     ACT,USERF(35);
4160=FR41 FREE,TERMFORK/1;
4170=FR42 FREE,MARSAREA/ATRIB(8);
4180=     ACT,USERF(38);
4190=TR16 TERM;
4200=;
4210=;    EXPLOSIVES
4220=AW37 AWAIT(38),EXFORK/1;
```

```
4230=       ACT,USERF(37);
4240=AW34  AWAIT(35),ALLOC(11);
4250=       ACT,,ATRIB(6).GT.0,AW37;
4260=       ACT,,,FR43;
4270=FR43  FREE,EXFORK/1;
4280=AW35  AWAIT(36),PALTEAM/1;
4290=       ACT,USERF(31);
4300=FR44  FREE,PALTEAM/1;
4310=       ACT,USERF(27);
4320=AW36  AWAIT(37),EXFORK/1;
4330=       ACT,USERF(37);
4340=FR45  FREE,EXFORK/1;
4350=FR50  FREE,EXMARS/ATRIB(8);
4360       ACT,USERF(39);
4370=TR17  TERM;
4380=       END NETWORK
4390=INIT,0,720;
4400=FIN;
4410=*EOR
```

```
100=      PROGRAM MAIN (INPUT,OUTPUT,TAPE5=INPUT,TAPE6=OUTPUT,TAPE7)
110=C
120=C*****************************************************************
130=C
140=C     MAIN PROGRAM IS USED TO INCREASE DIMENSION OF
150=C     NSET/ QSET TO 30000
160=C
170=C
180=      DIMENSION NSET(70000)
190=      COMMON/SCOM1/ ATRIB(100),DD(100),DDL(100),DTNOW,II,MFA,MSTOP,NCLNR
200=     +,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(100),SSL(100),TNEXT,TNOW,XX(100)
210=      COMMON QSET(70000)
220=      EQUIVALENCE (NSET(1),QSET(1))
230=      NNSET=70000
240=      NCRDR=5
250=      NPRNT=6
260=      NTAPE=7
270=      CALL SLAM
280=      STOP
290=      END
300=C
310=C*****************************************************************
320=C
330=C
340=      SUBROUTINE EVENT(I)
350=      DIMENSION NSET(70000)
360=      COMMON /SCOM1/ ATRIB(100),DD(100),DDL(100),DTNOW,II,MFA,
370=     +MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,
380=     +SS(100),SSL(100),TNEXT,TNOW,XX(100)
390=      COMMON QSET(70000)
400=      EQUIVALENCE (NSET(1),QSET(1))
410=      INTEGER NPAX,ALD,EAD,LAD,TYPE,N
420=      INTEGER VEHSTON,BULSTON,OVRSTON,OUTSTON,EXPSTON
430=      REAL A(9)
440=C
450=C
460=      GO TO (1,2,3,4,5,6),I
470=C*****************************************************************
480=1     CONTINUE
490=C     **EVENT 1 TAKES THE INPUT FROM TPFDD DATA CARDS AND AFTER THE
500=C       NEEDED MANIPULATIONS ARE DONE INSERTS THE ENTITIES INTO
510=C       SLAM FILE #1 FOR SORTING. FILE #1 IS THEN EMPTIED ONTO
520=C       DISC STORAGE AS FILE 'TAPE80' AND READ IN PERIODICALLY BY
530=C       EVENT(2).
540=C
550=C     **THE PROCESS WILL CONTINUE UNTIL ALL RECORDS HAVE BEEN READ.
560=C
570=C
580=C     N IS INITIALIZED HERE, IS USED AS A COUNTER IN EVENT(2)
```

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```
590=      N = 0
600=C
610=100   READ(60,50,END=200) BULSTON,OVRSTON,OUTSTON,NPAX,EXPSTON,
620=     +    ALD,EAD,LAD,TYPE
630=      IF(XX(99).EQ.1)PRINT50,BULSTON,OVRSTON,OUTSTON,NPAX,EXPSTON,
640=     +    ALD,EAD,LAD,TYPE
650=50    FORMAT(1X,I4,4(1X,I4),3(1X,I2),1X,I1)
660=C
670=C     **ATRIB(1) IS THE ARRIVAL TIME AT THE APOE.
680=      XX(1) = ALD * 24
690=      XX(2) = XX(1) + 24
700=      A(1) = UNFRM(XX(1),XX(2),1)
710=C
720=C     **ATRIB(2) IS THE EXPECTED DEPARTURE TIME.
730=      XX(1) = A(1) + XX(10)
740=      XX(4) = (BULSTON+OVRSTON+OUTSTON+EXPSTON) * .03
750=      XX(5) = (EAD * 24) - XX(10)
760=      XX(1) = MAX(XX(1),XX(4),XX(5))
770=      XX(2) = (LAD * 24)+24 - XX(3)
780=      A(2) = UNFRM(XX(1),XX(2),1)
790=C
800=C     **ATRIB(3) IS THE NUMBER OF PASSENGERS
810=      A(3) = NPAX
820=C
830=C     **ATRIB(7) IS THE TYPE OF UNIT
840=      A(7) = TYPE
850=C
860=C     **XX(23) IS NON-EXPLOSIVE CARGO TONS.
870=      XX(23) = BULSTON + OVRSTON + OUTSTON
880=C
890=C     **XX(21) IS THE VEHICULAR STON ESTIMATE
900=C        THE USER DETERMINES BY XX(52) WHICH ESTIMATION METHOD TO USE.
910=      IF (XX(52).EQ.0) THEN
920=           IF(A(7).EQ.2.OR.A(7).EQ.4) XX(21) = .75 * XX(23)
930=           IF(A(7).EQ.3.OR.A(7).EQ.5) XX(21) = .1 * XX(23)
940=           IF(A(7).EQ.1) XX(21) = 0.0
950=        ELSE IF (XX(52).EQ.1) THEN
960=           XX(21) = OVRSTON + OUTSTON
970=        ELSE
980=      END IF
990=C
1000=C    **XX(22) IS THE NON-VEHICULAR, NON-EXPLOSIVE STON ESTIMATE
1010=     XX(22) = XX(23) - XX(21)
1020=C
1030=C    **ATRIB(4) IS THE NUMBER OF VEHICLES
1040=     A(4) = NINT(XX(21)/XX(53))
1050=C
1060=C    **ATRIB(5) IS THE NUMBER OF PALLETS
1070=     A(5) = NINT(XX(22)/XX(54))
1080=C
1090=C    **ATRIB(6) IS THE NUMBER OF EXPLOSIVE PALLETS
1100=     A(6) = NINT(EXPSTON/XX(80))
```

```
1110=C
1120=C     **THE TRACE, IS ACTIVATED BY XX(99) =1, WILL PRINT THE ARRAY
1130=       IF(XX(99).EQ.1)PRINT 170,A(1),A(2),A(3),A(4),A(5),A(6),A(7)
1140=170   FORMAT(1X,7(1X,F7.2))
1150=C
1160=C
1170=C     **WITH ALL ATRIBUTES DEFINED, THE ENTITY IS FILED AWAY
1180=       CALL FILEM(1,A)
1190=C
1200=C     **RETURN TO DO THE NEXT ENTITY
1210=       GO TO 100
1220=C
1230=C     **END OF FILE TRIGGERS 200
1240=200   CALL RMOVE(1,1,A)
1250=       DO 77 I=1,7
1260=          WRITE (80,*) A(I)
1270=77    CONTINUE
1280=       IF (NNQ(1).GE.1) GO TO 200
1290=       REWIND 80
1300=       RETURN
1310=C
1320=C
1330=C
1340=C******************************************************************
1350=C     **EVENT 2 PULLS THE ENTITIES OUT OF FILE 1 AS THEIR ARRIVAL TIMES
1360=C      APPROACH. FILE 1 IS RANKED LVF ON ATRIB(1), THE ARRIVAL TIME,
1370=C      AND IS REPLENISHED WITH FRNS PULLED FROM THE INCOMING
1380=C      FRN LIST PREVIOUSLY WRITTEN TO TAPE80 BY EVENT(1). THE
1390=C      IDEA IS TO KEEP AT LEAST FIVE BUT NO MORE THAN 50 FRNS
1400=C      IN FILE 1 AT ALL TIMES, UNTIL THERE ARE NO MORE COMING.
1410=C
1420=2     IF (NNQ(1).LE.5.AND.XX(95).EQ.0) THEN
1430=          DO 78 K=1,50
1440=             DO 79 I=1,7
1450=                XX(95) = 1
1460=                READ (80,*,END=210) A(I)
1470=                XX(95) = 0
1480=79           CONTINUE
1490=             CALL FILEM(1,A)
1500=             N = N + 1
1510=78        CONTINUE
1520=210       IF(XX(95).EQ.1) THEN
1530=             PRINT*,N,' FRNS LOADED INTO FILE 1 AT',TNOW
1540=          END IF
1550=       END IF
1560=       IF(NNQ(1).EQ.0) RETURN
1570=       CALL RMOVE(1,1,ATRIB)
1580=C
1590=C     **THE TIME REMAINING TO ARRIVAL IS COMPUTED AND PLACED INTO
1600=C      ATRIB(1), AND USED AS THE DURATION OF THE LEAD IN ACTIVIT Y
1610=       ATRIB(1) = ATRIB(1) - TNOW
1620=       RETURN
```

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```
1630=C
1640=C*********************************************************************
1650=C     **THE NEW FIRST ENTITY'S ATRIBUTES ARE COPIED INTO ATRIB
1660=C       SO WE CAN DETERMINE WHEN IT WILL ARRIVE
1670=3     IF(NNQ(1).EQ.0) RETURN
1680=      CALL COPY(1,1,ATRIB)
1690=      ATRIB(1) = ATRIB(1) - TNOW
1700=      RETURN
1710=C
1720=C*********************************************************************
1730=C     EVENT 4  FREES THE RECEPTION POINT
1740=4     II=MAX(ATRIB(4),ATRIB(5),ATRIB(6))
1750=      CALL FREE(2,II)
1760=      RETURN
1770=C
1780=C*********************************************************************
1790=C     EVENT 5  FREES THE APPROPRIATE BILLET AREA FEEDING RESOURCE, AND
1800=C     CALCULATES THE NUMBER OF BUSES THIS GROUP NEEDS (ATRIB(7)).
1810=5     II=ATRIB(8)
1820=      IF(ATRIB(4).GT.0) CALL FREE(7,II)
1830=      IF(ATRIB(5).GT.0) CALL FREE(8,II)
1840=      IF(ATRIB(6).GT.0) CALL FREE(9,II)
1850=      ATRIB(7) = USERF(11)
1860=      ATRIB(8) = 0
1870=      RETURN
1880=C
1890=C*********************************************************************
1900=C     EVENT 6  FREES THE BILLETING AREAS, USING THE SAME LOOPING
1910=C     EMPLOYED TO ALLOCATE IT IN ALLOC(1)
1920=6     II=MAX(ATRIB(4),ATRIB(5),ATRIB(6))
1930=      DO 15 J=4,6
1940=         IF(ATRIB(J).GT.0) CALL FREE(J+6,II)
1950=15    CONTINUE
1960=      RETURN
1970=C
1980=      END
1990=C
2000=C*********************************************************************
2010=C
2020=C
2030=C     SUBROUTINE INTLC INITIALIZES THE XX(.) ARRAY
2040=C     TO 0.0, THEN SETS CERTAIN VARIABLES TO USER-
2050=C     DEFINED VALUES
2060=C     ALL TIMES ARE IN HOURS.
2070=C
2080=      SUBROUTINE INTLC
2090=      DIMENSION NSET(70000)
2100=      COMMON /SCOM1/ ATRIB(100),DD(100),DDL(100),DTNOW,II,MFA,
2110=     +MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,
2120=     +SS(100),SSL(100),TNEXT,TNOW,XX(100)
2130=      COMMON QSET(70000)
2140=      EQUIVALENCE (NSET(1),QSET(1))
```

```
2150=C
2160=C
2170=C      **THE ENTIRE XX(.) ARRAY IS FIRST SET TO 0.0**
2180=       DO 10 I=1,100
2190=          XX(I) = 0.0
2200=C
2210=C      **THEN CERTAIN VARIABLES ARE SET TO USER- DEFINED VALUES**
2220=C
2230=C      ** XX(1) THRU XX(2) INTERNAL USE
2240=C
2250=C      ** XX(3) = FLIGHT TIME TO THE COMBAT THEATER
2260=       XX(3) = 12.0
2270=C
2280=C      ** XX(4) THRU XX(5) INTERNAL USE
2290=C
2300=C      ** XX(6) = THE EARLIEST TIME PRIOR TO DEPARTURE THAT
2310=C         BILLETED FRNS MAY REPORT TO PAX STAGING
2320=       XX(6) = 8.0
2330=C
2340=C      ** XX(7) NOT USED
2350=C
2360=C      ** XX(8) IS THE MINIMUM TIME BEFORE DEPARTURE TO
2370=C         JUSTIFY ALLOCATION OF BILLETING
2380=       XX(8) = 18.0
2390=C
2400=C      ** XX(9) NOT USED
2410=C
2420=C      ** XX(10) = MINIMUM TIME TO PREPARE AN FRN
2430=       XX(10) = 8.0
2440=C
2450=C      ** XX(11) = PERCENTAGE OF VEHCILES NEEDING WASHING UPON ARRIVAL
2460=       XX(11) = .75
2470=C
2480=C      ** XX(12) = TIME BEFORE DEPARTURE TO TURN VEHICLES INTO PROCESSING
2490=       XX(12) = 8.0
2500=C
2510=C      ** XX(13) = TRANSIT TIME FROM RECEPTION TO VEHICLE PROCESSING
2520=       XX(13) = .3
2530=C
2540=C      ** XX(14) INTERNAL USE
2550=C
2560=C      ** XX(15) = PERCENTAGE OF VEHICLES PASSING JOINT INSPECTION.
2570=       XX(15) = .95
2580=C
2590=C      ** XX(16) = PERCENTAGE OF FAILED VEHICLES FAILING FOR WASHING
2600=       XX(16) = .75
2610=C
2620=C      ** XX(17) = PERCENTAGE OF PALLETS PASSING JOINT INSPECTION
2630=       XX(17) = .96
2640=C
2650=C      **XX(18) = TIME BEFORE DEPARTURE TO LOAD EXPLOSIVES ON K-LOADER
2660=       XX(18) = 1.0
```

```
2670=C
2680=C    ** XX(19) TIME BEFORE AIRCRAFT LOADING TO PUT CARGO ON K-LOADER
2690=     XX(19) = 1.0
2700=C
2710=C    ** XX(20) = PERCENTAGE OF FRNS WHICH HAVE THEIR OWN TRANSPORTATION
2720=     XX(20) = .5
2730=C
2740=C    ** XX(21) THRU XX(23) INTERNAL USE
2750=C
2760=C    ** XX(24) THRU XX(25) NOT USED
2770=C
2780=C    ** XX(26) = DURATION RECPOINT TO TRABIL1
2790=     XX(26) = .17
2800=C
2810=C    ** XX(27) = DURATION RECPOINT TO TRABIL2
2820=     XX(27) = .2
2830=C
2840=C    ** XX(28) = DURATION RECPOINT TO TRABIL3
2850=     XX(28) = .33
2860=C
2870=C    ** XX(29) THRU XX(30) NOT USED
2880=C
2890=C    ** XX(31) = TRANSPORTATION TIME TO EXPLOSIVE AREA
2900=     XX(31) = 1.0
2910=C
2920=C    ** XX(32) = PERCENTAGE OF UNIT PALLETS PASSING INITIAL INSPECTION.
2930=     XX(32) = .5
2940=C
2950=C    ** XX(33) THRU XX(35) NOT USED
2960=C
2970=C    ** XX(36) = DURATION TRABIL1 TO PAX STAGING
2980=     XX(36) = .22
2990=C
3000=C    ** XX(37) = DURATION TRABIL2 TO PAX STAGING
3010=     XX(37) = .25
3020=C
3030=C    ** XX(38) = DURATION TRABIL3 TO PAX STAGING
3040=     XX(38) = .33
3050=C
3060=C    **(39) THRU XX(41) NOT USED
3070=C
3080=C    ** XX(42) = DURATION RECPOINT TO PAX STAGING
3090=     XX(42) = .25
3100=C
3110=C    ** XX(43) = TYPE TRANSPORT PAX STAGING TO TERMINAL
3120=     XX(43) = 0
3130=C
3140=C    ** XX(44) = DURATION PAX STAGING TO TERMINAL
3150=     XX(44) = .03
3160=C
3170=C    ** XX(45) = EARLIEST TIME BEFORE DEPARTURE FRNS WILL
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3180=C        MOVE TO TERMINAL
3190=         XX(45) = 4.0
3200=C
3210=C    ** XX(46) = PERCENT OF AIRCRAFT PARKING SPOTS WITHIN WALKING
3220=C        DISTANCE OF THE TERMINAL
3230=         XX(46) = .60
3240=C
3250=C    ** XX(47) = ROUND TRIP TRANSPORT TIME TO AIRCRAFT VIA BUS
3260=         XX(47) = .33
3270=C
3280=C    ** XX(48) NOT USED
3290=C
3300=C    ** XX(49) = DURATION TERMINAL TO AIRCRAFT BY FOOT
3310=         XX(49) = .25
3320=C
3330=C    ** XX(50) = TYPE TRANSPORT MOBILITY LINE TO PAX STAGING
3340=C        (FOR ONBASE DEPLOYING PERSONNEL)
3350=         XX(50) = 1
3360=C
3370=C    ** XX(51) = DURATION MOBILITY LINE TO PAX STAGING
3380=         XX(51) = .5
3390=C
3400=C    XX(52) IS A SWITCH. IF SET TO 0, THE MAC % ARE USED IN ESTIMATING
3410=C    THE VEHICULAR CARGO (80% OF URC, 10% OF NRC). IF SET TO 1, THE
3420=C    TOTAL OF OVERSIZE AND OUTSIZE CARGO IS CONSIDERED TO BE VEHICULAR.
3430=         XX(52) = 0
3440=C
3450=C    ** XX(53) = AVERAGE VEHICLE WEIGHT IN SHORT TONS
3460=         XX(53) = 3.25
3470=C
3480=C    ** XX(54) = AVERAGE PALLET WEIGHT IN SHORT TONS
3490=         XX(54) = 1.7
3500=C
3510=C    ** XX(55) NOT USED
3520=C
3530=C    ** XX(56) = VEHICLE TRANSIT TIME FROM THE RECEPTION POINT
3540=C        TO THE WASHRACK
3550=         XX(56) = .05
3560=C
3570=C    ** XX(57) = VEHICLE TRANSIT TIME FROM WASHRACK TO VEHICLE
3580=C        PROCESSING AREA
3590=         XX(57) = .05
3600=C
3610=C    ** XX(58) THRU XX(62) NOT USED
3620=C
3630=C    ** XX(63) = TRANSIT TIME FROM JOINT INSPECTION (JI) TO WASHRACK
3640=         XX(63) = .03
3650=C
3660=C    ** XX(64) NOT USED
3670=C
3680=         XX(65) = .05
3690=C    ** XX(65) = TRANSIT TIME FROM VEHPROC TO VEHPARK
```

```
3700=C
3710=C     ** XX(66) THRU XX(71) NOT USED
3720=C
3730=C     ** XX(72) = TRANSIT TIME JI TO FRUSTRATED PALLET PROCESSING
3740=      XX(72) = .05
3750=C
3760=C     ** XX(73) THRU XX(74) NOT USED
3770=C
3780=C     ** XX(75) = TRANSIT TIME NRC RECEPTION PT TO NRC TERMINAL
3790=      XX(75) = .25
3800=C
3810=C     ** XX(76) IS A SWITCH- 1= ONBASE NRC IS PROCESSED BY SURFAC E
3820=C        FREIGHT SECTION, 0= NOT
3830=      XX(76) = 1
3840=C
3850=C     ** XX(77) THRU XX(79) NOT USED
3860=C
3870=C     ** XX(80) IS THE AVERAGE EXPLOSIVE PALLET WEIGHT
3880=      XX(80) = 4.0
3890=C
3900=C     ** XX(81) THRU XX(86) STATISTICS COLLECTION
3910=C
3920=C     ** XX(87) THRU XX(94) NOT USED
3930=C
3940=C     ** XX(95) IS USED IN EVENT(2), MUST BE LEFT EQUAL TO ZERO.
3950=C
3960=C     ** XX(96) THRU XX(97) NOT USED
3970=C
3980=C     ** XX(98) INTERNAL USE
3990=C
4000=C     ** XX(99) IS THE TRACE SWITCH: 0=OFF, 1=ON
4010=      XX(99) = 0
4020=      RETURN
4030=      END
4040=C
4050=C
4060=C
4070=C######################################################################
4080=      FUNCTION USERF(I)
4090=C
4100=C     USER FUNCTIONS DETERMINE VARIOUS PROCESSING
4110=C     TIMES AND FRN CHARACTERISTICS, BASED ON
4120=C     TRANSIT TIMES, RANDOM SELECTIONS, AND USER
4130=C     PROVIDED PROBABILITY ESTIMATES.  ALL TIMES
4140=C     ARE EXPRESSED IN HOURS AND DISTRIBUTIONS
4150=C     USED FOR RANDOM SELECTIONS ARE INDICATED
4160=C     IN THE CODE.
4170=C
4180=C
4190=      DIMENSION NSET(70000)
4200=      COMMON /SCOM1/ ATRIB(100),DD(100),DDL(100),DTNOW,II,MFA,
4210=     +NSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,
```

```
4220=     +SS(100),SSL(100),TNEXT,TNOW,XX(100)
4230=     COMMON QSET(70000)
4240=     EQUIVALENCE (NSET(1),QSET(1))
4250=C
4260=     GO TO (1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,
4270=     +22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40),I
4280=C
4290=C    THESE ALGORITHMS, PREPARED FOR DEMONSTRATION OF THE MODEL,  CAN BE
4300=C    ALTERED TO REFLECT THE USER'S SYSTEM OPERATION. THE VARIOUS
4310=C    USERFS SHOWN HERE DEMONSTRATE SEVERAL APPROACHES APPLICABLE TO
4320=C    A TYPICAL RECEPTION SYSTEM.
4330=C
4340=C*******************************************************************
4350=C    USERF(1) IS THE INPROCESSING TIME FOR OFFBASE DEPLOYING
4360=C    PERSONNEL.
4370=C
4380=1    USERF = TRIAG(.25,.5,1.0,2)
4390=     IF (XX(99).EQ.1) PRINT*,'USERF(1) = ',USERF,' AT TNOW = ',TNOW
4400=     RETURN
4410=C
4420=C*******************************************************************
4430=C
4440=C    USERF(2) CALCULATES THE TIME REMAINING BEFORE THE FRN IS
4450=C    SCHEDULED TO ENTER THE PAX STAGING AREA. THIS IS DRIVEN BY THE
4460=C    SCHEDULED DEPARTURE TIME, THE EARLIEST TIME BILLETED FRNS MAY
4470=C    REPORT TO THE PAX STAGING AREA, THE TRANSIT TIME FROM THE
4480=C    RECEPTION POINT TO THE PAX STAGING AREA, AND THE CURRENT TIME.
4490=C
4500=C
4510=2    USERF = ATRIB(2) - TNOW - XX(6) - XX(42)
4520=     IF (USERF.LT.0) THEN
4530=        USERF = 0
4540=     END IF
4550=     IF (XX(99).EQ.1) PRINT*,'USERF(2) = ',USERF,' AT TNOW = ',TNOW
4560=     RETURN
4570=C
4580=C*******************************************************************
4590=C
4600=C    USERF(3) THRU (5) CALCULATE THE NUMBER OF BUSES NEEDED. THESE
4610=C    CALCULATIONS ARE DRIVEN BY THE NUMBER OF PERSONS BEING SENT TO
4620=C    EACH OF THE BILLETING AREAS, AS REFLECTED BY ATRIBUTES 4-6.
4630=C    THE ALGORITHM ASSUMES THAT EACH UNIT OF 'BUS' RESOURCE IS A
4640=C    40 PAX BUS. ANY FRACTION OF A SINGLE BUSLOAD WILL BE GIVEN A BUS.
4650=C
4660=C    THE ALGORITHM USES INTEGER DIVISION, KEYING ON THE APPROPRIATE
4670=C    ATRIBUTE VALUE AND THE ASSUMPTION THAT EACH BUS HAS A NORMAL
4680=C    CAPACITY OF 40. AFTER DIVIDING THE ATRIBUTE BY 40, IT ADDS 1
4690=C    TO PUSH THE FIGURE OVER THE NEXT INTEGER IF THERE IS LESS THAN
4700=C    A FULL BUSLOAD. IT THEN TRUNCATES THE DECIMAL PART,
4710=C    RETURNING THE INTEGER VALUE.
4720=C
4730=C
```

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4740=3     USERF = INT(ATRIB(4)/40 + 1)
4750=      IF (XX(99).EQ.1) PRINT*,'ATRIB(4) = ',ATRIB(4),' USERF =',USERF
4760=      RETURN
4770=C
4780=C
4790=4     USERF = INT(ATRIB(5)/40 + 1)
4800=      IF (XX(99).EQ.1) PRINT*,'ATRIB(5) = ',ATRIB(5),' USERF =',USERF
4810=      RETURN
4820=C
4830=C
4840=5     USERF = INT(ATRIB(6)/40 + 1)
4850=      IF (XX(99).EQ.1) PRINT*,'ATRIB(6) = ',ATRIB(6),' USERF =',USERF
4860=      RETURN
4870=C
4880=C***********************************************************************
4890=C     USERF(6) COLLECTS PASSENGER STATISTIC
4900=6     IF(ATRIB(2).LT.TNOW)XX(81) = XX(81) + ATRIB(3)
4910=      IF(ATRIB(2).GE.TNOW)XX(82) = XX(82) + ATRIB(3)
4920=      USERF = 0
4930=      RETURN
4940=C
4950=C
4960=C     USERF(7) COLLECTS VEHICLE ON TIME PERCENTAGE
4970=C
4980=7     IF(ATRIB(2).LT.TNOW)XX(84) = XX(84) + XX(53)
4990=      IF(ATRIB(2).GE.TNOW)XX(85) = XX(85) + XX(53)
5000=      USERF = 0
5010=C
5020=      RETURN
5030=C
5040=C***********************************************************************
5050=C
5060=C     USERF(8) CALCULATES THE TIME THAT THE FRN HAS REMAINING IN THE
5070=C     TRANSIENT BILLETING AREA. THIS FIGURE IS DRIVEN BY THE SCHEDULED
5080=C     DEPARTURE TIME, THE CURRENT TIME, THE EARLIEST TIME TO
5090=C     ENTER PAX STAGING, AND THE TRANSIT TIME FROM EACH
5100=C     BILLETING AREA TO THE PAX STAGING AREA.
5110=C     NOTE THAT WHEN AN FRN IS SPLIT AMONG SEVERAL AREAS BY ALLOC(1),
5120=C     IT IN EFFECT BECOMES SEVERAL FRNS. EACH HAS THE SAME
5130=C     CHARACTERISTICS (DEPARTURE TIME,ETC), BUT FROM THIS POINT
5140=C     ON THE TOTAL PAX FIGURE (ATRIB(3)) IS MEANINGLESS UNLESS
5150=C     THE FRN DID NOT GO THROUGH BILLETING.
5160=C
5170=8     IF (ATRIB(4).GT.0) THEN
5180=          USERF = ATRIB(2) - TNOW - XX(6) - XX(36)
5190=        ELSE IF (ATRIB(5).GT.0) THEN
5200=          USERF = ATRIB(2) - TNOW - XX(6) - XX(37)
5210=        ELSE IF (ATRIB(6).GT.0) THEN
5220=          USERF = ATRIB(2) - TNOW - XX(6) - XX(38)
5230=      ELSE
5240=          USERF = ATRIB(2) - TNOW - XX(6)
5250=      END IF
```

```
5260=            IF (USERF.LT.0) THEN
5270=                USERF = 0.0
5280=            END IF
5290=        IF (XX(99).EQ.1) PRINT*,'TIME LEFT IN BILLETING = ',USERF
5300=        RETURN
5310=C
5320=C****************************************************************
5330=C
5340=C    USERF(9) CALCULATES THE PROCESSING TIME NEEDED IN PASSENGER
5350=C    STAGING.
5360=C
5370=9      USERF = ATRIB(3) * .008 + .15
5380=       IF(XX(99).EQ.1)PRINT*,'USERF(9) = ',USERF,' AT ',TNOW
5390=       RETURN
5400=C
5410=C****************************************************************
5420=C
5430=C    USERF(10) CALCULATES THE TIME REMAINING IN PAX STAGING UPON
5440=C    COMPLETION OF PROCESSING. THIS IS DRIVEN BY THE SCHEDULED
5450=C    DEPARTURE TIME, THE EARLIEST TIME FRNS MAY REPORT TO THE PAX
5460=C    TERMINAL, AND THE TRANSIT TIME FROM PAX STAGING TO THE TERMINAL.
5470=C
5480=C    NOTE THAT THIS IS A FUNCTION OF THE PARAMETER ESTABLISHED BY THE
5490=C    USER IN XX(45), THE EARLIEST TIME AN FRN MAY GO TO THE TERMINAL.
5500=C    THEREFORE, IF XX(45) IS SET VERY LARGE, THE FRNS WILL BE MOVED TO
5510=C    TERMINAL SOONER THAN IF IT IS SMALL. AS A CONSEQUENCE, MORE OF
5520=C    THEM WILL BE UNABLE TO MAKE THIS MOVE ON SCHEDULE, DUE TO EARLIER
5530=C    DELAYS. HOWEVER, BY SETTING XX(45) TO A LARGE VALUE, THERE IS A
5540=C    GREATER AMOUNT OF SLACK IN THE TERMINAL AREA, AND IT IS VERY
5550=C    LIKELY THAT AN FRN COULD SHOW UP AS 'LATE' GETTING TO THE
5560=C    TERMINAL, BUT STILL MAKE ITS SCHEDULED DEPARTURE.
5570=C
5580=10     USERF = ATRIB(2) - TNOW - XX(45) - XX(44)
5590=       IF (USERF.LT.0) THEN
5600=          USERF = 0
5610=       END IF
5620=       IF(XX(99).EQ.1) PRINT*,'USERF(10) = ',USERF
5630=       RETURN
5640=C
5650=C****************************************************************
5660=C
5670=C    USERF(11) CALCULATES THE NUMBER OF BUSES NEEDED BY THIS GROUP.
5680=C
5690=11     II = MAX(ATRIB(4),ATRIB(5),ATRIB(6))
5700=       IF(II.EQ.0) II = ATRIB(3)
5710=       USERF = INT(II/40.0 + 1)
5720=       IF (XX(99).EQ.1) PRINT*,'II = ',II,', USERF(11) = ',USERF
5730=       RETURN
5740=C
5750=C****************************************************************
5760=C
5770=C    USERF(12) CALCULATES THE PROCESSING TIME NEEDED IN THE PASSENGER
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5780=C    TERMINAL.
5790=C
5800=12   XX(7) = ATRIB(3) * .008 + .15
5810=     USERF = MIN(2.0,XX(7))
5820=     IF(XX(99).EQ.1) PRINT*,'USERF(12) = ',USERF,' AT ',TNOW
5830=     RETURN
5840=C
5850=C***********************************************************************
5860=C
5870=C    USERF(13) CHECKS TO SEE WHERE AN FRN IS GOING AND
5880=C    ASSIGNS THE APPROPRIATE TRANSIT TIME FROM THOSE PREVIOUSLY
5890=C    ESTABLISHED BY THE USER IN THE XX(.) ARRAY.
5900=C
5910=13   IF (ATRIB(4).GT.0) USERF = XX(26)
5920=     IF (ATRIB(5).GT.0) USERF = XX(27)
5930=     IF (ATRIB(6).GT.0) USERF = XX(28)
5940=     IF (XX(99).EQ.1) PRINT*,'USERF(13) = ',USERF
5950=     RETURN
5960=C
5970=C***********************************************************************
5980=C
5990=C    USERF(14) CHECKS TO SEE FROM WHICH AREA AN FRN IS COMING, AND
6000=C    ASSIGNS THE APPROPRIATE TRANSIT TIME ESTABLISHED BY THE
6010=C    USER IN THE XX(.) ARRAY.
6020=C
6030=14   IF (ATRIB(4).GT.0) USERF = XX(36)
6040=     IF (ATRIB(5).GT.0) USERF = XX(37)
6050=     IF (ATRIB(6).GT.0) USERF = XX(38)
6060=     IF (XX(99).EQ.1) PRINT*,'USERF(14) = ',USERF
6070=     RETURN
6080=C
6090=C***********************************************************************
6100=C
6110=C    USERF(15) DETERMINES THE NUMBER OF VEHICLES IN AN FRN
6120=C    WHICH WILL NEED WASHING UPON ARRIVAL.
6130=C
6140=15   USERF = NINT(ATRIB(4) * XX(11))
6150=     IF(XX(99).EQ.1)PRINT*,'USERF(15) = ',USERF,' AT ',TNOW
6160=     RETURN
6170=C
6180=C***********************************************************************
6190=C
6200=C    USERF(16) AND (17) CALCULATE THE TIME REMAINING IN THE TERMINAL
6210=C    FOLLOWING THE COMPLETION OF FINAL PROCESSING. THE FIRST IS USED
6220=C    FOR THOSE FRNS WHO WILL BE WALKING TO THEIR AIRCRAFT, AND THE
6230=C    SECOND FOR THOSE WHO WILL REQUIRE BUS TRANSPORT. NOTE THAT THESE
6240=C    FACTORS ARE SET BY THE USER AS PERCENTAGES IN XX(46).
6250=C    THIS IS INCLUDED TO ALLOW FOR DIFFERENT AIRFIELD LAYOUTS, IN
6260=C    WHICH SOME PARKING SPOTS MAY BE CLOSE TO THE TERMINAL AND OTHERS
6270=C    ARE FAR AWAY. ALSO, POLICY CHANGES MAY BE MODELED. FOR INSTANCE,
6280=C    BASE X MAY DECIDE THAT IN GOOD WEATHER ALL AIRCRAFT WILL BE
6290=C    WITHIN WALKING DISTANCE, WHILE IN BAD WEATHER (SUCH AS WINTER)
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6300=C    ONLY 2 OUT OF 10 (20%) AIRCRAFT WILL BE PARKED WITHIN WALKING
6310=C    DISTANCE. EACH OF THESE POLICIES COULD BE EXAMINED FOR THE IMPACT
6320=C    ON THE BUS RESOURCE, AND WHETHER THE RESOURCES AVAILABLE WILL BE
6330=C    ENOUGH.
6340=C
6350=C     IT IS POSSIBLE THAT ALL FRNS COULD BE ON SCHEDULE UP
6360=C    TO THIS POINT, AND STILL BE LATE REACHING THEIR AIRCRAFT DUE TO
6370=C    THE STRUCTURE OF THE MODEL. AN FRN WHICH IS TO BE BUSED TO THE
6380=C    AIRCRAFT WILL NOT PRESENT ITSELF FOR BUS ALLOCATION UNTIL XX(47)
6390=C    HOURS PRIOR TO ITS SCHEDULED DEPARTURE FROM THE SYSTEM, WHERE
6400=C    XX(47) IS SET BY THE USER TO BE THE AVERAGE TRANSIT TIME BY BUS
6410=C    TO THE AIRCRAFT. THEREFORE, IF THE FRN NEEDS MORE BUSES THAN ARE
6420=C    AVAILABLE AT THAT MOMENT, IT WILL BE SOMEWHAT LATE IN GETTING TO
6430=C    THE AIRCRAFT. SINCE THE 'SCHEDULED DEPARTURE TIME' USED THROUGH-
6440=C    OUT THIS MODEL REFERS TO DEPARTURE FROM THE RECEPTION SYSTEM,
6450=C    (WHICH IS ACTUALLY THE FRN'S ARRIVAL AT THE AIRCRAFT), SOME DELAY
6460=C    IS ACCEPTABLE SINCE THEY SHOULD BE LOADING SOME 1-2 HOURS PRIOR
6470=C    TO TAKE-OFF.
6480=C
6490=16   USERF = ATRIB(2) - XX(49) - TNOW
6500=     IF (USERF.LT.0) THEN
6510=        USERF=0
6520=     END IF
6530=     IF (XX(99).EQ.1) PRINT*,'USERF(16) = ',USERF,', TNOW = ',TNOW
6540=     RETURN
6550=C
6560=C
6570=17   USERF = ATRIB(2) - XX(47) - TNOW - (.4*ATRIB(7))
6580=     IF (USERF.LT.0) THEN
6590=        USERF = 0
6600=     END IF
6610=     IF (XX(99).EQ.1) PRINT*,'USERF(17) = ',USERF,', TNOW = ',TNOW
6620=     RETURN
6630=C
6640=C******************************************************************
6650=C
6660=C    USERF(18) IS THE TIME TO BUILD AND INSPECT ONE PALLET.
6670=18   USERF = TRIAG(.5,.75,1.0,2)
6680=     IF(XX(99).EQ.1)PRINT*,'USERF(18) = ',USERF,' AT ',TNOW
6690=     RETURN
6700=C
6710=C******************************************************************
6720=C
6730=C    USERF(19) CALCULATES THE CARGO INPROCESSING TIME, BASED ON THE
6740=C    TOTAL AMOUNT OF CARGO (ATRIB(4)). THE TIME IS EXPRESSED IN HOURS.
6750=C
6760=19   USERF = TRIAG(.1,.6,1.25,2)
6770=     IF (XX(99).EQ.1) PRINT*,'USERF(19) = ',USERF,' TIME = ',TNOW
6780=     RETURN
6790=C
6800=C******************************************************************
6810=C
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6820=C USERF(20) DETERMINES IF UNIT RELATED PAX WILL HAVE THEIR OWN TRANSPORT
6830=C
6840=20   XX(98) = DRAND(4)
6850=        IF(XX(98).LE.XX(20)) USERF = 0
6860=        IF(XX(98).GT.XX(20)) USERF = 1
6870=     IF(XX(99).EQ.1)PRINT*,'USERF(20) = ',USERF,' AT ',TNOW
6880=     RETURN
6890=C
6900=C***********************************************************************
6910=C
6920=C     USERF(21) DETERMINES HOW LONG UNITS  MAY KEEP
6930=C     THEIR OWN VEHICLES BEFORE TURNING THEM OVER TO VEHICLE PROCESSING.
6940=C
6950=21   USERF = ATRIB(2) - TNOW - XX(12)
6960=        IF(USERF.LT.0)THEN
6970=          USERF = 0
6980=        ENDIF
6990=     IF(XX(99).EQ.1)PRINT*,'USERF(21) = ',USERF,' AT ',TNOW
7000=     RETURN
7010=C
7020=C***********************************************************************
7030=C
7040=C     USERF(22) IS THE VEHICLE INSPECTION TIME.
7050=C
7060=22   USERF = TRIAG(.06,.25,.33,2)
7070=     IF (XX(99).EQ.1) PRINT*,'USERF(22) = ',USERF,' TIME = ',TNOW
7080=     RETURN
7090=C
7100=C***********************************************************************
7110=C
7120=C     USERF(23) DETERMINES IF VEHICLES PASS JOINT INSPECTION AND THE
7130=C     REASON FOR FAILURE.
7140=C
7150=23   XX(98)=DRAND(4)
7160=        IF(XX(98).LE.XX(15))THEN
7170=          USERF = 0
7180=        ELSE
7190=          XX(98) = DRAND(4)
7200=          IF(XX(98).LE.XX(16)) USERF = 1
7210=          IF(XX(98).GT.XX(16)) USERF = 2
7220=        ENDIF
7230=     IF(XX(99).EQ.1)PRINT*,'USERF(23) = ',USERF,' AT ',TNOW
7240=     RETURN
7250=C
7260=C***********************************************************************
7270=C
7280=C     USERF(24) CALCULATES THE TIME LEFT IN THE PARKING AREA AFTER
7290=C     JI IS FINISHED. IF THIS TIME IS NEGATIVE THE TIME IS SET TO
ZERO.
7300=C
7310=24   USERF = ATRIB(2) - TNOW
7320=     IF (USERF.LT.0) THEN
```

```
7330=        USERF=0
7340=      END IF
7350=      IF (XX(99).EQ.1) PRINT*,'USERF(24) = ',USERF,' TIME = ',TNOW
7360=      RETURN
7370=C
7380=C************************************************************************
7390=C
7400=C     USERF(25) DETERMINES IF A PALLET PASSES JOINT INSPECTION.
7410=C
7420=25   XX(98) = DRAND(4)
7430=        IF(XX(98).LE.XX(17))USERF = 0
7440=        IF(XX(98).GT.XX(17))USERF = 1
7450=      IF(XX(99).EQ.1)PRINT*,'USERF(25) = ',USERF,' AT ',TNOW
7460=      RETURN
7470=C
7480=C************************************************************************
7490=C
7500=C     USERF(26) DETERMINES THE NUMBER OF VEHICLES IN AN FRN WHICH WILL
7510=C     NOT NEED WASHING.
7520=C
7530=26   USERF = NINT(ATRIB(4) * (1-XX(11)))
7540=      IF(XX(99).EQ.1)PRINT*,'USERF(26) = ',USERF,' AT ',TNOW
7550=      RETURN
7560=C
7570=C************************************************************************
7580=C
7590=C     USERF(27) DETERMINES THE TIME UNTIL PALETIZED EXPLOSIVES WILL BE
7600=C     LOADED ON A K-LOADER. THE DRAND(4) FACTOR STAGGERS THE PALLET
7610=C     LOADING SCHEDULE FOR LARGE FRNS.
7620=C
7630=27   USERF = ATRIB(2) - TNOW - XX(18) - DRAND(4)
7640=        IF(USERF.LT.0) THEN
7650=            USERF = 0
7660=        END IF
7670=      IF (XX(99).EQ.1)PRINT*,'USERF(27) = ',USERF,' AT ',TNOW
7680=      RETURN
7690=C
7700=C************************************************************************
7710=C
7720=C     USERF(28) DETERMINES THE BUS DISPATCH TIME TO PICK UP PASSENGERS.
7730=C
7740=28   USERF = TRIAG(0.0,.17,.33,2)
7750=      IF(XX(99).EQ.1) PRINT*,'USERF(28) = ',USERF,' AT ',TNOW
7760=      RETURN
7770=C
7780=C************************************************************************
7790=C
7800=C     USERF(29) IS THE PALLET INSPECTION TIME.
7810=C
7820=29   USERF=TRIAG(.08,.165,.25,2)
7830=      IF (XX(99).EQ.1) PRINT*,'USERF(29) = ',USERF,' TIME = ',TNOW
7840=      RETURN
```

```
7850=C
7860=C*********************************************************************
7870=C
7880=C      USERF(30) IS THE TIME NEEDED TO REWORK FRUSTRATED PALLETS.
7890=C
7900=30    USERF=TRIAG(.25,1.0,2.0,2)
7910=      IF (XX(99).EQ.1) PRINT*,'USERF(30) = ',USERF,' TIME = ',TNOW
7920=      RETURN
7930=C
7940=C*********************************************************************
7950=C
7960=C      USERF(31) DETERMINES THE TIME TO BUILD AN EXPLOSIVE PALLET.
7970=C
7980=31    USERF = TRIAG(.75,1.0,1.5,2)
7990=      IF (XX(99).EQ.1) PRINT*,'USERF(31) =',USERF,' AT ',TNOW
8000=      RETURN
8010=C
8020=C*********************************************************************
8030=C         .
8040=C      USERF(32) CALCULATES THE TIME REMAINING  IN MARSHALLING.
8050=C
8060=32    USERF = ATRIB(2) - TNOW - XX(19) - DRAND(4)
8070=      IF (USERF.LT.0) THEN
8080=         USERF = 0.0
8090=      END IF
8100=      IF (XX(99).EQ.1) PRINT*,'USERF(32) = ',USERF,' TIME = ',TNOW
8110=      RETURN
8120=C
8130=C*********************************************************************
8140=C
8150=C      USERF(33) IS THE VEHICLE WASH TIME.
8160=33    USERF = TRIAG(.06,.25,.5,2)
8170=      IF(XX(99).EQ.1)PRINT*,'USERF(33) = ',USERF,' AT ',TNOW
8180=      RETURN
8190=C
8200=C*********************************************************************
8210=C
8220=C      USERF(34) IS THE VEHICLE PROCESSING TIME.
8230=34    USERF = TRIAG(.06,.25,.33,2)
8240=      IF(XX(99).EQ.1)PRINT*,'USERF(34) = ',USERF,' AT ',TNOW
8250=      RETURN
8260=C
8270=C*********************************************************************
8280=C
8290=C      USERF(35) IS THE TIME TO LOAD/UNLOAD ONE PALLET OF GENERAL CARGO.
8300=35    USERF = TRIAG(.01,.0165,.06,2)
8310=      IF(XX(99).EQ.1)PRINT*,'USERF(35) = ',USERF,' AT ',TNOW
8320=      RETURN
8330=C
8340=C*********************************************************************
8350=C
8360=C      USERF(36) IS THE TIME TO RECEIVE ONE PALLET OF CARGO IN THE
```

```
8370=C     FREIGHT SECTION.
8380=C
8390=36    USERF = TRIAG(.01,.02,.03,2)
8400=      IF(XX(99).EQ.1)PRINT*,'USERF(36) = ',USERF,' AT ',TNOW
8410=      RETURN
8420=C
8430=C*************************************************************************
8440=C
8450=C     USERF(37) IS THE TIME TO LOAD/UNLOAD ONE PALLET OF EXPLOSIVES.
8460=C
8470=37    USERF = TRIAG(.15,.2,.25,2)
8480=      IF(XX(99).EQ.1)PRINT*,'USERF(37) = ',USERF,' AT ',TNOW
8490=      RETURN
8500=C
8510=C*************************************************************************
8520=C
8530=C     USERF(38) COLLECTS GENERAL CARGO PALLET ON-TIME PERCENTAGE.
8540=C
8550=38    IF(ATRIB(2).LT.TNOW)XX(84) = XX(84) + XX(54)
8560=      IF(ATRIB(2).GE.TNOW)XX(85) = XX(85) + XX(54)
8570=      USERF = 0
8580=      RETURN
8590=C
8600=C*************************************************************************
8610=C
8620=C     USERF(39) COLLECTS EXPLOSIVE PALLET ON-TIME PERCENTAGE.
8630=C
8640=39    IF(ATRIB(2).LT.TNOW)XX(84)=XX(84) + XX(80)
8650=      IF(ATRIB(2).GE.TNOW)XX(85) = XX(85) + XX(80)
8660=      USERF = 0
8670=      RETURN
8680=C
8690=C*************************************************************************
8700=C
8710:      USERF(40) DETERMINES THE NUMBER OF PEOPLE IN A GROUP COMING
8720=C     FROM VARIOUS AREAS.
8730=C
8740=40    II = MAX(ATRIB(4),ATRIB(5),ATRIB(6))
8750=      IF(II.GT.0)USERF = II
8760=      IF(II.EQ.0)USERF = ATRIB(3)
8770=      RETURN
8780=      END
8790=C*************************************************************************
8800=      SUBROUTINE ALLOC(IAC,IFLAG)
8810=      DIMENSION NSET(70000)
8820=      COMMON /SCOM1/ ATRIB(100),DD(100),DDL(100),DTNOW,II,MFA,
8830=     +MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,
8840=     +SS(100),SSL(100),TNEXT,TNOW,XX(100)
8850=      COMMON QSET(70000)
8860=      EQUIVALENCE (NSET(1),QSET(1))
8870=C
8880=      GO TO (1,2,3,4,5,6,7,8,9,10,11),IAC
```

```
8980=C
8900=C*********************************************************************
8910=C
8920=C     ALLOC(1) ALLOCATES TRANSIENT BILLETING. BILLETING IS IN 3
8930=C     AREAS, LABELLED TRABIL1- TRABIL3. THE LABELS CORRESPOND TO THE
8940=C     PREFERENCE THAT THE MANAGERS WILL GIVE TO THE AREAS. IN OTHER
8950=C     WORDS, AREA 1 WOULD NORMALLY BE USED BEFORE AREA 2, AND SO ON. IT
8960=C     IS NOT NECESSARY THAT ALL THREE AREAS BE USED. IF A PARTICULAR BASE
8970=C     ONLY ESTABLISHES TWO AREAS, THEN THE USER NEED ONLY SET THE
8980=C     AVAILABILITY OF AREA 3 TO ZERO ON THE 'RESOURCE' CARD IN
8990=C     THE NETWORK PORTION OF THE INPUT. THIS WILL PREVENT THE MODEL FROM
9000=C     EVER ASSIGNING ANY FRN TO THAT AREA.
9010=C
9020=C     IN DEFINING THE AVAILABILITY OF BILLETING, THE 'UNIT OF ISSUE' IS
9030=C     ONE SLEEPING SPACE. THIS ASSUMES THAT THE ASSOCIATED SERVICES ARE
9040=C     PROVIDED AS WELL (SANITARY FACILITIES, TRASH REMOVAL, ETC.).
9050=C
9060=C     THE FIRST STEP IN THE ALLOCATION IS A RE-EXAMINATION OF THE TIME
9070=C     REMAINING BEFORE DEPARTURE. IF THE FRN HAS BEEN WAITING TOO LONG,
9080=C     THERE IS NO LONGER ANY POINT IN SENDING THEM TO BILLETING. THEY
9090=C     ARE INSTEAD ROUTED BACK TO THE NETWORK, WHICH SENDS THEM TO PAX
9100=C     STAGING.
9110=1     ATRIB(1) = ATRIB(2) - TNOW
9120=      IF (ATRIB(1).LT.XX(8)) THEN
9130=         IFLAG = 1
9140=         RETURN
9150=      END IF
9160=C
9170=C     IF THERE IS STILL ENOUGH TIME TO BILLET THEM, WE FIRST TRY TO PUT
9180=C     THE ENTIRE FRN IN ONE AREA.
9190=C
9200=      II=ATRIB(3)
9210=      DO 25 J=4,6
9220=         IF (NNRSC(J+6).GE.II) THEN
9230=            CALL SEIZE(J+6,II)
9240=            ATRIB(J) = II
9250=            IFLAG = 1
9260=            RETURN
9270=         END IF
9280=25    CONTINUE
9290=C
9300=C     FAILING TO PUT THEM INTO ONE AREA, WE NEXT CHECK TO SEE IF THERE
9310=C     ARE ENOUGH SPACES IN ALL AREAS COMBINED.
9320=C     IF THERE ARE NOT, THE FRN IS TOLD TO WAIT IN THE QUEUE. IF THERE
9330=C     ARE ENOUGH SLOTS SCATTERED AROUND, WE START BY ALLOCATING THE
9340=C     LARGEST CHUNK FIRST. THIS CONTINUES UNTIL THE ENTIRE FRN HAS BEEN
9350=C     BILLETED.
9360=C
9370=      II=NNRSC(10) + NNRSC(11) + NNRSC(12)
9380=      IF (II.LT.ATRIB(3)) THEN
9390=         IFLAG = 0
9400=         RETURN
```

```
9410=          ELSE
9420=              NNEED = ATRIB(3)
9430=100          II=MAX(NNRSC(10),NNRSC(11),NNRSC(12))
9440=             DO 20 K=4,6
9450=             IF(II.EQ.NNRSC(K+6)) THEN
9460=                 IF (II.LE.NNEED) THEN
9470=                     CALL SEIZE(K+6,II)
9480=                     ATRIB(K) = II
9490=                     NNEED=NNEED-II
9500=                 ELSE
9510=                     CALL SEIZE(K+6,NNEED)
9520=                     ATRIB(K)=NNEED
9530=                     NNEED=0
9540=                     IFLAG=1
9550=                     RETURN
9560=                 END IF
9570=             END IF
9580=20           CONTINUE
9590=        60 TO 100
9600=        END IF
9610=C
9620=C
9630=C**********************************************************************
9640=C
9650=C    ALLOC(2) IS THE BUS ALLOCATION ROUTINE, AND IS USED IN SEVERAL
9660=C    LOCATIONS. IN EVERY CASE, WHEN AN FRN ARRIVES AT A NODE TO RECEIVE
9670=C    BUSES, IT CARRIES WITH IT ATRIBUTE 7, WHICH IS THE NUMBER OF
9680=C    BUSES IT NEEDS, AND ATRIBUTE 8, WHICH IS THE NUMBER OF BUSE SIT
9690=C    HAS AT THE MOMENT (0 TO START WITH). THE ROUTINE FIRST ATTEMPTS TO
9700=C    GIVE THE FRN ALL THE BUSES IT NEEDS AT ONE TIME. FAILING THIS, IT
9710=C    GIVES ALL THE BUSES THAT ARE AVAILABLE. IF NONE ARE AVAILABLE, THE
9720=C    FRN IS TOLD TO WAIT.
9730=C
9740=C    AS BUSES ARE ALLOCATED, ATRIBUTE 7 IS DECREMENTED BY THAT NUMBER
9750=C    AND REPRESENTS THE NUMBER OF BUSLOADS OF PEOPLE STILL WAITING FOR
9760=C    TRANSPORTATION. AS SHOWN BY THE NETWORK DIAGRAM IN CHAPTER FOUR,
9770=C    AS LONG AS ATRIBUTE 7 IS GREATER THAN 0, THE FRN WILL CC...INUE TO
9780=C    LOOP BACK TO THE AWAIT NODE TO RECEIVE THE BUSES IT STILL NEEDS.
9790=C
9800=C    THESE BUSES MAY COME FROM EITHER THE ONES IN USE BY THIS FRN,
9810=C    COMING BACK FOR A SECOND LOAD, OR FROM BUSES BEING RELEASED FROM
9820=C    OTHER PARTS OF THE NETWORK. WHICHEVER THE CASE, THEY ARE AL LOCATED
9830=C    AND ATRIB(8) SHOWS HOW MANY THE FRN CURRENTLY HAS. THIS IS THE
9840=C    NUMBER WHICH WILL BE RELEASED AFTER THE DURATION OF THE TRIP HAS
9850=C    ELAPSED.
9860=C
9870=C
9880=2      II=ATRIB(7)
9890=      IF (NNRSC(4).GE.II) THEN
9900=           CALL SEIZE(4,II)
9910=           ATRIB(7) = 0
9920=           ATRIB(8) = II
```

```
 9930=          IFLAG = 1
 9940=        ELSE IF (NNRSC(4).GT.0) THEN
 9950=          ATRIB(7) = ATRIB(7) - NNRSC(4)
 9960=          ATRIB(8) = NNRSC(4)
 9970=          CALL SEIZE(4,NNRSC(4))
 9980=          IFLAG = 1
 9990=        ELSE
10000=          IFLAG = 0
10010=      END IF
10020=C
10030=      RETURN
10040=C****************************************************************************
10050=C
10060=C      ALLOC(3) ALLOCATES BILLET AREA FEEDING CAPABILITY. IN DEFINING
10070=C      THIS RESOURCE, THE MANAGERS MUST TAKE INTO ACCOUNT THE CAPABILITY
10080=C      OF SOME TRANSIENT FRNS TO FEED THEMSELVES. AS THIS THESIS IS BEING
10090=C      PREPARED, THIS CAPABILITY IS LARGELY A MYSTERY. WHEN IT BECOMES
10100=C      KNOWN THAT A GIVEN UNIT WILL ARRIVE ON A CERTAIN DAY AND WILL SET
10110=C      UP A FIELD KITCHEN FOR 15 DAYS, THE MODEL CAN BE MODIFIED TO TAKE
10120=C      INTO ACCOUNT THE INCREASED LEVEL OF FEEDING RESOURCE THAT SUCH A
10130=C      KITCHEN WOULD PROVIDE FOR THOSE 15 DAYS. AT THIS TIME, HOWEVER,
10140=C      THAT LEVEL OF DETAIL IS NOT ATTEMPTED. THE MANAGERS SHOULD MERELY
10150=C      ATTEMPT TO DEFINE THE NUMBER OF MEALS THEY COULD SERVE AT EACH
10160=C      AREA. FOR THIS RESOURCE, EACH AREA IS CONSIDERED SEPERATE, EVEN
10170=C      THOUGH A SINGLE SOURCE MIGHT PROVIDE MEALS FOR ALL BILLETING
10180=C      AREAS. IN SUCH A CASE, THE AVAILABILITY SHOULD BE DIVIDED AMONG
10190=C      THE SEVERAL AREAS. FURTHERMORE, THE AVAILABILITY OF MEALS IS
10200=C      MEASURED IN SERVINGS PER SIX HOURS, ON THE ASSUMPTION THAT A 24-
10210=C      HOUR SCHEDULE IS IN EFFECT. THIS MEANS THAT IF A KITCHEN CAN SERVE
10220=C      600 MEALS PER HOUR, 24 HOURS PER DAY, THEY HAVE AN AVAILABILITY OF
10230=C      600 X 6 = 3600 UNITS PER CYCLE.
10240=C
10250=C      ON THIS BASIS, AN FRN OF 200 PERSONS WILL BE ALLOCATED 200 UNITS
10260=C      OF THAT 3600, AND WILL KEEP THEM UNTIL THEY DEPART THE BILLETING
10270=C      AREA. SHOULD THE MANAGERS WISH TO PROVIDE ONE MEAL EVERY 12
10280=C      HOURS, THEY SIMPLY MULTIPLY THE HOURLY CAPABILITY BY 12 INSTEAD OF
10290=C      BY 6.
10300=C
10310=C      THE ALGORITHM USED CONSIDERS EACH OF THE ATRIBUTES (4-6) IN TURN
10320=C      TO SEE IF THE FRN HAS PEOPLE IN THAT AREA. IF SO, IT ATTEMPTS TO
10330=C      ALLOCATE THE FEEDING RESOURCE. IF THERE IS INSUFFICIENT RESOURCE
10340=C      AVAILABLE, THIS WILL NOT PREVENT THE FRN FROM LEAVING ON TIME.
10350=C      THEREFORE, THE ROUTINE MERELY PRINTS AN ADVISORY NOTICE AND ALLOWS
10360=C      THE FRN TO MOVE ON. TO KEEP THE MODEL SIMPLE, NO ATTEMPT IS MADE
10370=C      AT ANY LATER DATE TO ALLOCATE FEEDING WHICH BECOMES AVAILABLE TO
10380=C      THOSE FRNS WHICH DID NOT RECEIVE IT AT THIS POINT.
10390=C
10400=3     CONTINUE
10410=      IF(ATRIB(4).GT.0) THEN
10420=        IF(NNRSC(7).GE.ATRIB(4))THEN
10430=            II=ATRIB(4)
10440=            ATRIB(8)=II
```

```
10450=                CALL SEIZE(7,II)
10460=            ELSE IF (NNRSC(7).GT.0) THEN
10470=                II=ATRIB(4)-NNRSC(7)
10480=                ATRIB(8)=NNRSC(7)
10490=                CALL SEIZE(7,NNRSC(7))
10500=            ELSE
10510=                II=ATRIB(4)
10520=                ATRIB(8) = 0
10530=         END IF
10540=      END IF
10550=C
10560=      IF(ATRIB(5).GT.0) THEN
10570=         IF(NNRSC(8).GE.ATRIB(5))THEN
10580=                II=ATRIB(5)
10590=                ATRIB(8)=II
10600=                CALL SEIZE(8,II)
10610=            ELSE IF (NNRSC(8).GT.0) THEN
10620=                II=ATRIB(5)-NNRSC(8)
10630=                ATRIB(8)=NNRSC(8)
10640=                CALL SEIZE(8,NNRSC(8))
10650=            ELSE
10660=                II=ATRIB(5)
10670=                ATRIB(8) = 0
10680=         END IF
10690=      END IF
10700=C
10710=      IF(ATRIB(6).GT.0) THEN
10720=         IF(NNRSC(9).GE.ATRIB(6))THEN
10730=                II=ATRIB(6)
10740=                ATRIB(8)=II
10750=                CALL SEIZE(9,II)
10760=            ELSE IF (NNRSC(9).GT.0) THEN
10770=                II=ATRIB(6)-NNRSC(9)
10780=                ATRIB(8)=NNRSC(9)
10790=                CALL SEIZE(9,NNRSC(9))
10800=            ELSE
10810=                II=ATRIB(6)
10820=                ATRIB(8) = 0
10830=         END IF
10840=      END IF
10850=      IFLAG=1
10860=      RETURN
10870=C
10880=C*********************************************************************
10890=C    EVENT 4 AND 5 NOT USED
10900=4     RETURN
10910=5     RETURN
10920=C
10930=C*********************************************************************
10940=C
10950=C    ALLOC(6) ALLOCATES WASHRACKS TO THE VEHICLES, ONE AT A TIME.
10960=C
```

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```
10970=6     IF (NNRSC(16).GT.0) THEN
10980=          ATRIB(7) = ATRIB(7) - 1
10990=          ATRIB(8) = 1
11000=          CALL SEIZE(16,1)
11010=          IFLAG = 1
11020=       ELSE
11030=          IFLAG = 0
11040=     END IF
11050=     RETURN
11060=C
11070=C**********************************************************************
11080=C
11090=C     ALLOC(7) ALLOCATES VEHICLE PROCESSING SPACE. EACH SLOT
11100=C     REPRESENTS SPACE FOR ONE VEHICLE TO BE DEFUELED, WEIGHED, AND
11110=C     OTHERWISE PREPARED FOR SHIPMENT. THE LOGIC USED HERE IS IDENTICAL
11120=C     TO THAT USED FOR THE WASHRACKS.
11130=C
11140=C
11150=7     IF (NNRSC(17).GT.0) THEN
11160=          ATRIB(8) = ATRIB(8) - 1
11170=          CALL SEIZE(17,1)
11180=          IFLAG = 1
11190=       ELSE
11200=          IFLAG = 0
11210=     END IF
11220=     RETURN
11230=C
11240=C**********************************************************************
11250=C
11260=C     ALLOC(8) ALLOCATES NON-UNIT RECEPTION AREA. ATRIB(8) IS THE NUMBER
11270=C     OF PALLETS IN THIS FRN. RESOURCE 30 IS DEFINED AS PALLET CAPACITY.
11280=C     AN OVERFLOW WILL NOT STOP THE FRN.
11290=C
11300=8     IF(NNRSC(26).EQ.0)THEN
11310=        ATRIB(8) = 0
11320=     ELSE
11330=        ATRIB(8) = 1
11340=        CALL SEIZE(26,1)
11350=     END IF
11360=     ATRIB(5) = ATRIB(5) - 1
11370=     IFLAG = 1
11380=     RETURN
11390=C
11400=C**********************************************************************
11410=C     EVENT 9 NOT USED
11420=9     RETURN
11430=C**********************************************************************
11440=C
11450=C     ALLOC(10) ALLOCATES PALLET SPACE IN THE MARSHALLING AREA.
11460=C     ATTRIB(8) WAS REDEFINED AS THE NUMBER OF PALLETS IN THIS
11470=C     GROUP.  RESOURCE 24 IS THE PALLET CAPACITY.  IT IS ASSUMED
11480=C     THAT AN OVERFLOW OF THE ALLOCATED AREA WILL NOT PREVENT
```

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```
11490=C     TIMELY DEPARTURES.
11500=C
11510=10    IF (NNRSC(20).EQ.0) THEN
11520=      ATRIB(8) = 0
11530=         ELSE
11540=           CALL SEIZE(20,1)
11550=             ATRIB(8) = 1
11560=      END IF
11570=      ATRIB(5) = ATRIB(5) - 1
11580=      IFLAG = 1
11590=      RETURN
11600=C*****************************************************************************
11610=C     ALLOC(11) ALLOCATES EXPLOSIVE MARSHALLING AREA.
11620=C     AN OVERFLOW WILL NOT STOP THE FRN FROM BEING PROCESSED.
11630=C
11640=11    IF(NNRSC(23).EQ.0)THEN
11650=      ATRIB(8) = 0
11660=      ELSE
11670=        ATRIB(8) = 1
11680=        CALL SEIZE(23,1)
11690=      END IF
11700=      IFLAG = 1
11710=      ATRIB(6) = ATRIB(6) - 1
11720=      RETURN
11730=      END
11740=C
11750=C*****************************************************************************
11760=C
11770=      SUBROUTINE OTPUT
11780=      DIMENSION NSET(70000)
11790=      COMMON/SCOM1/ ATRIB(100),DD(100),DDL(100),DTNOW,II,MFA,MSTO P,NCLNR
11800=     +,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(100),SSL(100),TNEXT,TNOW, XX(100)
11810=      COMMON QSET(70000)
11820=      EQUIVALENCE (NSET(1),QSET(1))
11830=C
11840=      XX(83) = XX(82)/(XX(81)+XX(82))
11850=      XX(86) = XX(85)/(XX(84)+XX(85))
11960=      PRINT*,'PASSENGER PERCENTAGE = ',XX(83)
11870=      PRINT*,'CARGO PERCENTAGE = ',XX(86)
11880=      RETURN
11890=      END
11900=*EOR
```

APPENDIX F

SIMULATED TPFDD INPUT

:

```
100=     PROGRAM FILE
110=     INTEGER BULSTON,OUTSTON,OVRSTON,NPAX,EXPSTON,ALD,EAD,LAD,TY PE
120=     DO 50 J=1,700
130=     R=RANF()
140=     ALD=NINT(R*30)
150=     EAD=NINT(ALD+R*2)
160=     IF(EAD.EQ.ALD)EAD=ALD+1
170=     LAD=NINT(EAD+R*10)
180=     IF(LAD.LT.EAD)LAD=EAD
190=     IF(R.LE..4)TYPE=2
200=     IF(R.GT..4.AND.R.LE..6)TYPE=3
210=     IF(R.GT..6.AND.R.LE..9)TYPE=4
220=     IF(R.GT..9)TYPE=5
230=     IF(TYPE.EQ.2)THEN
240=        EXPSTON=0
250=        Z=RANF()
260=        IF(Z.LT..5)THEN
270=           BULSTON=0
280=        ELSE
290=           R=RANF()
300=           BULSTON=R*120
310=        ENDIF
320=        Z=RANF()
330=        IF(Z.LT..6)THEN
340=           OVRSTON=0
350=        ELSE
360=           R=RANF()
370=           BULSTON=R*33
380=        ENDIF
390=        Z=RANF()
400=        IF(Z.LT..7)THEN
410=           OUTSTON=0
420=        ELSE
430=           R=RANF()
440=           OUTSTON=R*35
450=        ENDIF
460=        Z=RANF()
470=        IF(Z.LT..2)THEN
480=           NPAX=0
490=        ELSE
500=           R=RANF()
510=           NPAX=R*50
520=        ENDIF
530=     ELSEIF(TYPE.EQ.3)THEN
540=        NPAX=0
550=        Z=RANF()
560=        IF(Z.LT.5)THEN
570=           BULSTON=0
```

```
580=        ELSE
590=           R=RANF()
600=           BULSTON=R*66
610=        ENDIF
620=        Z=RANF()
630=        IF(Z.LT..6)THEN
640=           OVRSTON=0
650=           OUTSTON=0
660=        ELSE
670=           R=RANF()
680=           OVRSTON=R*42
690=           R=RANF()
700=           OUTSTON=R*42
710=        ENDIF
720=        Z=RANF()
730=        IF(Z.LT..7)THEN
740=           EXPSTON=0
750=        ELSE
760=           R=RANF()
770=           EXPSTON=R*225
780=        ENDIF
790=     ELSEIF(TYPE.EQ.4)THEN
800=        EXPSTON=0
810=        OVRSTON=0
820=        OUTSTON=0
830=        Z=RANF()
840=        IF(Z.LT..8)THEN
850=           NPAX=0
860=        ELSE
870=           R=RANF()
880=           NPAX=R*250
890=        ENDIF
900=        Z=RANF()
910=        IF(Z.LT..1)THEN
920=           BULSTON=0
930=        ELSE
940=           R=RANF()
950=           BULSTON=R*17
960=        ENDIF
970=     ELSEIF(TYPE.EQ.5)THEN
980=        EXPSTON=0
990=        Z=RANF()
1000=        IF(Z.LT..3)THEN
1010=           NPAX=0
1020=        ELSE
1030=           R=RANF()
1040=           NPAX=R*50
1050=        ENDIF
1060=        Z=RANF()
1070=        IF(Z.LT..4)THEN
1080=           BULSTON=0
1090=           OVRSTON=0
```

```
1100=          OUTSTON=0
1110=        ELSE
1120=          R=RANF()
1130=          BULSTON=R*30
1140=          OVRSTON=R*20
1150=          OUTSTON=R*10
1160=        ENDIF
1170=      ENDIF
1180=      IF(J.LT.5)PRINT5,BULSTON,OVRSTON,OUTSTON,NPAX,EXPSTON,ALD,E AD,
1190=     +LAD,TYPE
1200=      S=BULSTON+OVRSTON+OUTSTON+NPAX
1210=      IF(S.GT.0)WRITE(80,5)BULSTON,OVRSTON,OUTSTON,NPAX,EXPSTON,
1220=     +ALD,EAD,LAD,TYPE
1230=5     FORMAT(1X,A4,5(1X,I4),3(1X,I2),1X,I1)
1240=50    CONTINUE
1250=      STOP
1260=      END
1270=*EOR ..
```

	1	2	3	4	5	6	7	8	9
100=	0	12	19	0	0	17	18	24	3
110=	12	12	0	29	0	8	9	12	2
120=	2	12	34	46	0	3	4	5	2
130=	27	12	0	0	0	6	7	9	2
140=	112	0	0	44	0	9	10	13	2
150=	0	39	25	0	0	15	16	21	3
160=	7	0	0	0	0	27	29	38	4
170=	0	24	18	0	0	14	15	20	3
180=	4	3	1	0	0	28	30	39	5
190=	6	0	0	0	0	25	27	35	4
200=	0	0	0	33	0	8	9	12	2
210=	6	0	0	0	0	20	21	28	4
220=	21	0	0	0	0	3	4	5	2
230=	26	17	8	19	0	29	31	41	5
240=	108	0	0	29	0	2	3	4	2
250=	0	0	0	6	0	8	9	12	2
260=	0	29	21	0	126	15	16	21	3
270=	26	29	0	42	0	9	10	13	2
280=	3	0	0	0	0	26	28	37	4
290=	4	0	0	47	0	6	7	9	2
300=	0	15	27	0	0	16	17	22	3
310=	14	0	0	0	0	27	29	38	4
320=	30	0	17	47	0	4	5	6	2
330=	0	0	0	37	0	29	31	41	5
340=	13	0	0	209	0	24	26	34	4
350=	0	14	12	0	10	14	15	20	3
360=	0	0	18	5	0	6	7	9	2
370=	0	0	24	47	0	11	12	16	2
380=	0	0	0	26	0	29	31	41	5
390=	75	0	0	9	0	7	8	10	2
400=	!	0	0	0	0	18	19	25	4
410=	5	0	0	0	0	26	28	37	4
420=	0	0	10	0	0	11	12	16	2
430=	0	1	2	0	0	16	17	22	3
440=	0	16	31	0	0	12	13	17	3
450=	15	0	0	0	0	20	21	28	4
460=	9	0	0	9	0	10	11	14	2
470=	114	0	0	0	0	5	6	8	2
480=	9	0	0	0	0	20	21	28	4
490=	11	0	0	0	0	5	6	8	2
500=	0	0	8	12	0	2	3	4	2
510=	27	0	0	26	0	2	3	4	2
520=	17	11	5	15	0	27	29	38	5
530=	0	39	25	0	203	16	17	22	3
540=	14	0	0	0	0	19	20	26	4
550=	0	0	0	16	0	12	13	17	2
560=	43	0	18	18	0	9	10	13	2
570=	0	0	0	3	0	10	11	14	2

580=	10	0	0	15	0	4	5	6 2
590=	5	0	0	227	0	23	25	33 4
600=	0	12	30	0	0	15	16	21 3
610=	8	5	2	0	0	30	32	42 5
620=	26	17	8	0	0	29	31	41 5
630=	0	40	1	0	163	15	16	21 3
640=	10	40	0	0	0	1	2	2 2
650=	3	0	0	49	0	9	10	13 2
660=	0	14	25	0	0	17	18	24 3
670=	17	14	0	47	0	11	12	16 2
680=	0	31	40	0	0	13	14	18 3
690=	15	0	0	0	0	24	26	34 4
700=	0	0	0	47	0	27	29	38 5
710=	7	0	0	3	0	8	9	12 2
720=	16	0	0	12	0	4	5	6 2
730=	0	0	0	46	0	1	2	2 2
740=	0	13	31	0	0	15	16	21 3
750=	11	13	0	24	0	9	10	13 2
760=	8	0	0	0	0	21	22	29 4
770=	6	4	2	49	0	29	31	41 5
780=	3	4	0	26	0	8	9	12 2
790=	0	0	0	40	0	3	4	5 2
800=	10	0	0	0	0	20	21	28 4
810=	0	0	0	34	0	30	32	42 5
820=	0	0	20	10	0	0	1	1 2
830=	0	0	0	18	0	4	5	6 2
840=	8	0	0	0	0	11	12	16 2
850=	13	0	0	0	0	19	20	26 4
860=	1	0	0	6	0	29	31	41 5
870=	0	0	0	43	0	8	9	12 2
880=	10	0	0	0	0	23	25	33 4
890=	0	0	10	0	0	4	5	6 2
900=	0	0	7	14	0	4	5	6 2
910=	0	11	7	0	6	12	13	17 3
920=	0	14	26	0	0	17	18	24 3
930=	25	0	11	10	0	1	2	2 2
940=	0	5	23	0	0	15	16	21 3
950=	15	0	0	0	0	19	20	26 4
960=	92	0	27	0	0	1	2	2 2
970=	38	0	0	41	0	7	8	10 2
980=	8	0	0	0	0	24	26	34 4
990=	21	0	0	0	0	2	3	4 2
1000=	105	0	0	16	0	6	7	9 2
1010=	22	0	0	0	0	0	1	1 2
1020=	16	0	0	47	0	1	2	2 2
1030=	8	0	0	0	0	18	19	25 4
1040=	12	0	0	⁊	0	25	27	35 4
1050=	31	0	0	14	0	4	5	6 2
1060=	8	0	0	10	0	27	29	38 4
1070=	4	0	0	5	0	23	25	33 4
1080=	30	0	0	24	0	12	13	17 2
1090=	7	0	0	41	0	9	10	13 2

```
1100=    9     0     0     0     0 20 21 28 4
1110=   25     0     0     7     0  4  5  6 2
1120=   11     0     0   225     0 21 22 29 4
1130=   20    13     6     0     0 28 30 39 5
1140=    2     0     0     0     0 19 20 26 4
1150=    0    30    20     0     0 13 14 18 3
1160=  108     0     0    35     0  7  8 10 2
1170=    3     0     0     0     0 20 21 28 4
1180=   12     0     0     0     0 23 25 33 4
1190=    8     0     0   146     0 23 25 33 4
1200=   12     8     4     9     0 29 31 41 5
1210=   37     0     0    16     0  1  2  2 2
1220=   18    12     6    28     0 29 31 41 5
1230=    8     0     0     0     0 26 28 37 4
1240=   16     0     0     0     0 27 29 38 4
1250=    3     0     0     0     0 22 23 30 4
1260=   33     0     0    42     0  4  5  6 2
1270=    8     0     0     0     0 22 23 30 4
1280=    8     0     0     0     0 20 21 28 4
1290=    4     0     0     0     0 27 29 38 4
1300=   27    18     9     0     0 29 31 41 5
1310=   26    17     8    49     0 29 31 41 5
1320=   16     0     0     0     0 20 21 28 4
1330=   24     0     0    19     0  8  9 12 2
1340=    6     0     0    38     0 12 13 17 2
1350=    0     0     0    37     0 30 32 42 5
1360=   29     0    19    48     0 11 12 16 2
1370=    0     0     0    12     0  8  9 12 2
1380=    9     0     0   186     0 27 29 38 4
1390=   38     0     0     0     0  3  4  5 2
1400=   31     0     0     0     0  4  5  6 2
1410=   11     0     0     0     0 21 22 29 4
1420=    2     0     0     0     0 24 26 34 4
1430=    9     0     0     0     0 21 22 29 4
1440=   32     0    10    37     0 10 11 14 2
1450=   13     0     0     5     0  8  9 12 2
1460=    9     0     0     0     0 21 22 29 4
1470=    4     0     0     0     0 24 26 34 4
1480=   10     0     0     7     0 12 13 17 2
1490=    0     0     0    36     0  9 10 13 2
1500=    1     0     0     0     0 30 32 42 5
1510=   66     0     0     0     0  5  6  8 2
1520=    0    10    38     0     0 15 16 21 3
1530=    6     0     0    95     0 21 22 29 4
1540=    0     0     0     5     0 30 32 42 5
1550=   11     0     0     0     0 26 28 37 4
1560=   13     0     0     0     0 25 27 35 4
1570=    0     3    13     0     0 17 18 24 3
1580=    0     0    14     0     0  9 10 13 2
1590=   26    17     8    43     0 29 31 41 5
1600=    0     0     0    15     0 30 32 42 5
1610=    3     0     0     0     0 26 28 37 4
```

1620=	11	0	11	23	0	3	4	5	2
1630=	11	0	0	16	0	2	3	4	2
1640=	0	20	17	0	0	13	14	18	3
1650=	7	0	0	0	0	20	21	28	4
1660=	15	0	0	0	0	21	22	29	4
1670=	0	0	0	7	0	5	6	8	2
1680=	10	0	0	0	0	21	22	29	4
1690=	6	0	14	13	0	4	5	6	2
1700=	9	0	0	0	0	20	21	28	4
1710=	3	0	0	0	0	20	21	28	4
1720=	0	38	33	0	0	15	16	21	3
1730=	9	0	0	0	0	20	21	28	4
1740=	0	0	34	0	0	3	4	5	2
1750=	3	0	0	0	0	23	25	33	4
1760=	22	0	0	10	0	7	8	10	2
1770=	20	0	0	35	0	1	2	2	2
1780=	8	0	0	14	0	6	7	9	2
1790=	15	0	0	1	0	8	9	12	2
1800=	74	0	0	37	0	8	9	12	2
1810=	14	0	0	0	0	23	25	33	4
1820=	3	0	0	0	0	25	27	35	4
1830=	0	0	0	42	0	30	32	42	5
1840=	12	8	4	0	0	28	30	39	5
1850=	6	0	0	26	0	21	22	29	4
1860=	0	0	11	10	0	6	7	9	2
1870=	1	0	0	0	0	22	23	30	4
1880=	16	0	0	36	0	8	9	12	2
1890=	0	36	41	0	0	17	18	24	3
1900=	30	36	0	13	0	6	7	9	2
1910=	0	12	9	0	0	16	17	22	3
1920=	0	22	32	0	0	17	18	24	3
1930=	4	0	0	0	0	25	27	35	4
1940=	8	0	0	3	0	7	8	10	2
1950=	11	0	0	0	0	25	27	35	4
1960=	18	0	0	4	0	6	7	9	2
1970=	15	0	0	0	0	25	27	35	4
1980=	2	0	0	0	0	23	25	33	4
1990=	19	13	6	0	0	29	31	41	5
2000=	7	0	0	100	0	25	27	35	4
2010=	15	0	2	0	0	6	7	9	2
2020=	27	0	0	23	0	6	7	9	2
2030=	1	0	18	49	0	6	7	9	2
2040=	0	0	0	2	0	10	11	14	2
2050=	61	0	0	38	0	3	4	5	2
2060=	0	0	0	1	0	6	7	9	2
2070=	14	0	0	0	0	18	19	25	4
2080=	0	0	14	25	0	9	10	13	2
2090=	0	20	0	0	49	12	13	17	3
2100=	0	18	8	0	0	13	14	18	3
2110=	32	18	0	31	0	8	9	12	2
2120=	0	0	1	0	0	6	7	9	2
2130=	0	0	28	23	0	11	12	16	2

2140=	0	0	0	45	0	11	12	16	2
2150=	17	11	5	14	0	28	30	39	5
2160=	25	11	0	1	0	9	10	13	2
2170=	2	0	0	21	0	10	11	14	2
2180=	0	0	0	29	0	12	13	17	2
2190=	23	0	0	30	0	2	3	4	2
2200=	0	22	28	0	0	13	14	18	3
2210=	31	22	15	26	0	11	12	16	2
2220=	80	0	0	7	0	7	8	10	2
2230=	0	30	36	0	103	13	14	18	3
2240=	13	0	0	0	0	21	22	29	4
2250=	0	0	0	41	0	2	3	4	2
2260=	21	0	24	10	0	4	5	6	2
2270=	26	0	0	25	0	11	12	16	2
2280=	0	35	39	0	0	17	18	24	3
2290=	8	35	33	31	0	1	2	2	2
2300=	19	35	0	43	0	3	4	5	2
2310=	7	0	0	0	0	22	23	30	4
2320=	0	5	31	0	0	17	18	24	3
2330=	0	0	0	15	0	11	12	16	2
2340=	0	0	21	0	0	12	13	17	2
2350=	13	0	0	25	0	11	12	16	2
2360=	11	0	0	0	0	19	20	26	4
2370=	32	0	17	15	0	1	2	2	2
2380=	0	0	0	32	0	28	30	39	5
2390=	3	0	0	0	0	19	20	26	4
2400=	0	0	0	17	0	7	8	10	2
2410=	3	0	0	0	0	24	26	34	4
2420=	0	0	0	21	0	28	30	39	5
2430=	0	0	0	41	0	30	32	42	5
2440=	8	0	0	0	0	23	25	33	4
2450=	2	0	0	0	0	21	22	29	4
2460=	8	0	0	49	0	9	10	13	2
2470=	110	0	0	0	0	9	10	13	2
2480=	0	0	27	0	0	6	7	9	2
2490=	0	20	0	0	0	18	19	25	3
2500=	0	0	0	4	0	3	4	5	2
2510=	1	1	0	22	0	30	32	42	5
2520=	13	0	0	22	0	26	28	37	4
2530=	0	0	0	26	0	28	30	39	5
2540=	16	0	0	22	0	11	12	16	2
2550=	88	0	5	17	0	6	7	9	2
2560=	5	0	0	0	0	18	19	25	4
2570=	8	0	0	0	0	24	26	34	4
2580=	9	0	0	0	0	22	23	30	4
2590=	8	0	0	0	0	24	26	34	4
2600=	0	0	27	12	0	1	2	2	2
2610=	0	41	2	0	0	15	16	21	3
2620=	8	0	16	6	0	8	9	12	2
2630=	13	0	0	0	0	26	28	37	4
2640=	4	0	0	10	0	26	28	37	4
2650=	0	0	0	29	0	4	5	6	2

```
2660=    9     0     0     0      0 26 28 37 4
2670=   10     0     0   238      0 21 22 29 4
2680=   10     0     0     0      0 27 29 38 4
2690= 109     0     0     4      0  1  2  2 2
2700=   31     0     0     0      0  7  8 10 2
2710=    0     0     4    26      0  5  6  8 2
2720=    0    10    40     0      0 14 15 20 3
2730=   12     0     0     0      0 19 20 26 4
2740=   15    10     5     0      0 27 29 38 5
2750=   20     0     0    49      0  0  1  1 2
2760=    3     0     0     0      0 25 27 35 4
2770=    0     0     0     3      0  7  8 10 2
2780=    0     0    34     0      0 11 12 16 2
2790=    0     0     0    32      0 11 12 16 2
2800=    6     0     0     0      0 24 26 34 4
2810=    0    19    23     0      0 16 17 22 3
2820=   16     0     0    64      0 24 26 34 4
2830=   59     0     0     0      0 10 11 14 2
2840=   81     0     0    15      0  2  3  4 2
2850=   11     0     0   168      0 21 22 29 4
2860=   16     0     0     0      0 22 23 30 4
2870=   88     0     0     0      0  2  3  4 2
2880=   15     0     0   115      0 21 22 29 4
2890=    0     0    25    12      0 11 12 16 2
2900=    5     0     0   110      0 23 25 33 4
2910=   13     0     0     0      0 22 23 30 4
2920=    6     0     0     1      0  1  2  2 2
2930=   15    10     5     0      0 27 29 38 5
2940=    4     0     0     0      0·20 21 28 4
2950=    8     0     0     0      0 22 23 30 4
2960=    3     0     0     0      0 22 23 30 4
2970=    0     0    20    41      0  6  7  9 2
2980=    3     0     0     0      0 25 27 35 4
2990=    9     0     0     0      0 23 25 33 4
3000=    5     0     0    14      0  8  9 12 2
3010=    9     0    19    17      0  1  2  2 2
3020=    1     0     0    11      0 10 11 14 2
3030=   15     0    14    49      0 10 11 14 2
3040=   23    15     7    41      0 27 29 38 5
3050=    0     0     0    39      0  8  9 12 2
3060=    0     0     0     5      0  2  3  4 2
3070=    7     0     0   140      0 26 28 37 4
3080=   41     0    25    40      0  5  6  8 2
3090=   14     0    19     0      0  4  5  6 2
3100= 101     0     0    43      0  0  1  1 2
3110=    0    30    31     0     64 16 17 22 3
3120=    0     0     0     8      0  3  4  5 2
3130=   21     0    19     0      0  0  1  1 2
3140=    1     0     0     0      0 27 29 38 4
3150=    6     0     0   104      0 26 28 37 4
3160=    9     0     0     0      0 26 28 37 4
3170=    9     0     0     0      0 23 25 33 4
```

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```
3180=  17   0   0   12     0 10 11 14 2
3190=  23  15   7   49     0 28 30 39 5
3200=   6   4   2   19     0 29 31 41 5
3210=   0   0   0   42     0  4  5  6 2
3220=   6   0   0    0     0 27 29 38 4
3230=  20   0   0   24     0 10 11 14 2
3240=  27   0  17    0     0  3  4  5 2
3250=   0   0   0   26     0 11 12 16 2
3260=   1   0   0    0     0 26 28 37 4
3270=   9   0   0    0     0 22 23 30 4
3280=  14   0   0    0     0  3  4  5 2
3290=  11   0   0    0     0 22 23 30 4
3300=   7   4   2    7     0 27 29 38 5
3310=   0  19  37    0    87 14 15 20 3
3320=  21  14   7    0     0 29 31 41 5
3330= 116   0   6   42     0  3  4  5 2
3340=   2   0   0  173     0 27 29 38 4
3350=   0   0   0    9     0  0  1  1 2
3360=  30   0   0    0     0  9 10 13 2
3370=   2   0   0    0     0 19 20 26 4
3380=  20   0  31    0     0  1  2  2 2
3390=   5   0   0   21     0  3  4  5 2
3400=   6   0   0    0     0 18 19 25 4
3410=  13   0   0    0     0 21 22 29 4
3420=  31   0   0   12     0  2  3  4 2
3430=  85   0   0   17     0  7  8 10 2
3440=   6   0   0    0     0 19 20 26 4
3450=   0   0   0   11     0  8  9 12 2
3460=   8   0   0    0     0 26 28 37 4
3470=   8   0   0    0     0 21 22 29 4
3480=  23  15   7   19     0 29 31 41 5
3490=   7   0   0    0     0 23 25 33 4
3500=  25   0  34   32     0  2  3  4 2
3510=  11   0   0    0     0 21 22 29 4
3520=  20   0   0    0     0  3  4  5 2
3530=  15   0   0    0     0 18 19 25 4
3540=   3   0   0    0     0 23 25 33 4
3550=  27   0   0   48     0  2  3  4 2
3560=  20   0   0    0     0  6  7  9 2
3570=   0   0   0  234     0 25 27 35 4
3580=   8   0   0    0     0 20 21 28 4
3590=  67   0  12   29     0 10 11 14 2
3600=  31   0  19   24     0  5  6  8 2
3610=   5   0   0   48     0 12 13 17 2
3620=  92   0   0    0     0  8  9 12 2
3630=   0   0   0    1     0 11 12 16 2
3640=  31   0   0   14     0  7  8 10 2
3650=   6   0   0    0     0 26 28 37 4
3660=  45   0   0   34     0 11 12 16 2
3670=   5   0   0   39     0  4  5  6 2
3680=   0  14  23    0     0 17 18 24 3
3690=   0  16  15    0     0 17 18 24 3
```

3700=	9	0	0	119	0	24	26	34	4
3710=	0	0	0	27	0	1	2	2	2
3720=	14	9	4	0	0	30	32	42	5
3730=	20	0	0	0	0	6	7	9	2
3740=	14	0	0	0	0	24	26	34	4
3750=	19	12	6	34	0	29	31	41	5
3760=	3	0	0	0	0	25	27	35	4
3770=	77	0	0	41	0	7	8	10	2
3780=	4	2	1	46	0	28	30	39	5
3790=	14	2	0	35	0	6	7	9	2
3800=	22	2	0	0	0	4	5	6	2
3810=	0	33	37	0	217	17	18	24	3
3820=	31	33	34	38	0	1	2	2	2
3830=	95	0	0	8	0	1	2	2	2
3840=	3	0	0	0	0	20	21	28	4
3850=	6	0	0	0	0	21	22	29	4
3860=	0	0	6	12	0	7	8	10	2
3870=	0	0	0	35	0	2	3	4	2
3880=	57	0	0	25	0	12	13	17	2
3890=	14	0	0	0	0	22	23	30	4
3900=	0	0	0	3	0	25	27	35	4
3910=	26	0	0	9	0	4	5	6	2
3920=	0	0	0	36	0	11	12	16	2
3930=	1	0	0	36	0	12	13	17	2
3940=	51	0	0	0	0	1	2	2	2
3950=	1	0	0	127	0	24	26	34	4
3960=	6	0	0	6	0	6	7	9	2
3970=	0	0	0	15	0	27	29	38	5
3980=	3	0	0	0	0	2	3	4	2
3990=	86	0	22	41	0	10	11	14	2
4000=	0	0	5	40	0	7	8	10	2
4010=	9	0	0	110	0	22	23	30	4
4020=	9	0	0	0	0	24	26	34	4
4030=	20	0	0	31	0	8	9	12	2
4040=	13	0	0	0	0	24	26	34	4
4050=	12	0	0	0	0	18	19	25	4
4060=	2	0	0	193	0	21	22	29	4
4070=	12	0	0	205	0	19	20	26	4
4080=	112	0	0	0	0	10	11	14	2
4090=	20	0	0	5	0	5	6	8	2
4100=	16	0	0	0	0	25	27	35	4
4110=	14	0	0	0	0	19	20	26	4
4120=	0	33	34	0	0	16	17	22	3
4130=	24	33	28	0	0	9	10	13	2
4140=	12	8	4	0	0	30	32	42	5
4150=	0	0	0	7	0	3	4	5	2
4160=	27	0	0	26	0	1	2	2	2
4170=	18	0	0	29	0	3	4	5	2
4180=	23	0	0	19	0	1	2	2	2
4190=	0	0	0	31	0	11	12	16	2
4200=	0	15	40	0	0	13	14	18	3
4210=	60	0	0	5	0	11	12	16	2

4220=	3	0	0	0	0	20	21	28	4
4230=	2	0	0	32	0	4	5	6	2
4240=	3	0	0	0	0	23	25	33	4
4250=	6	0	6	14	0	6	7	9	2
4260=	0	8	5	0	0	13	14	18	3
4270=	7	0	0	0	0	25	27	35	4
4280=	6	0	19	21	0	10	11	14	2
4290=	10	0	0	0	0	26	28	37	4
4300=	0	34	26	0	176	13	14	18	3
4310=	113	0	21	25	0	12	13	17	2
4320=	0	0	0	5	0	28	30	39	5
4330=	83	0	10	8	0	4	5	6	2
4340=	16	0	0	0	0	20	21	28	4
4350=	0	0	0	35	0	29	31	41	5
4360=	0	0	0	10	0	11	12	16	2
4370=	7	0	19	42	0	3	4	5	2
4380=	0	33	3	0	0	16	17	22	3
4390=	0	28	16	0	0	16	17	22	3
4400=	10	0	0	0	0	20	21	28	4
4410=	14	0	0	0	0	20	21	28	4
4420=	14	0	0	0	0	26	28	37	4
4430=	6	0	0	0	0	24	26	34	4
4440=	20	0	0	40	0	9	10	13	2
4450=	100	0	0	13	0	2	3	4	2
4460=	6	0	0	0	0	19	20	26	4
4470=	0	13	28	0	39	16	17	22	3
4480=	0	13	19	0	0	7	8	10	2
4490=	0	0	0	42	0	2	3	4	2
4500=	81	0	28	15	0	12	13	17	2
4510=	21	0	13	11	0	12	13	17	2
4520=	9	0	0	0	0	22	23	30	4
4530=	4	0	0	23	0	7	8	10	2
4540=	8	0	30	15	0	7	8	10	2
4550=	1	0	0	92	0	24	26	34	4
4560=	115	0	21	21	0	10	11	14	2
4570=	8	0	0	0	0	19	20	26	4
4580=	115	0	0	6	0	9	10	13	2
4590=	0	0	11	0	0	12	13	17	2
4600=	13	0	0	52	0	27	29	38	4
4610=	0	0	0	33	0	2	3	4	2
4620=	0	0	22	0	0	16	17	22	3
4630=	3	0	34	40	0	5	6	8	2
4640=	11	7	3	18	0	30	32	42	5
4650=	0	0	25	0	0	2	3	4	2
4660=	7	0	28	1	0	10	11	14	2
4670=	12	0	0	156	0	27	29	38	4
4680=	0	0	0	40	0	11	12	16	2
4690=	0	0	0	10	0	12	13	17	2
4700=	34	0	11	20	0	8	9	12	2
4710=	25	0	0	30	0	4	5	6	2
4720=	25	0	0	0	0	6	7	9	2
4730=	4	0	0	0	0	20	21	28	4

```
4740=    0   39   35    0      0 14 15 20 3
4750=    4    0    0    0      0 19 20 26 4
4760=    0   13   33    0    128 13 14 18 3
4770=   25   13    0   47      0  7  8 10 2
4780=    5    3    1    0      0 30 32 42 5
4790=    0   17    8    0      0 14 15 20 3
4800=   18   17    0    0      0 10 11 14 2
4810=   11   17    0   16      0  6  7  9 2
4820=   24   17    0    8      0 11 12 16 2
4830=   10    0    5    9      0  4  5  6 2
4840=   30    0    0    2      0  7  8 10 2
4850=   60    0    0    5      0  5  6  8 2
4860=    0    0    0   41      0  6  7  9 2
4870=    0    0    0   18      0  2  3  4 2
4880=    0    7   26    0      0 18 19 25 3
4890=    0   39   34    0      0 18 19 25 3
4900=    1    0    0    0      0  3  4  5 2
4910=   14    0    0    0      0  9 10 13 2
4920=    0    0    0   43      0 29 31 41 5
4930=   11    0    0    0      0 24 26 34 4
4940=    0    0   41    0    161 13 14 18 3
4950=    0    0   13    1      0  8  9 12 2
4960=    0    5   31    0    208 15 16 21 3
4970=    0   18   21    0    150 14 15 20 3
4980=    2    0    0  233      0 24 26 34 4
4990=    6    4    2   39      0 30 32 42 5
5000=    7    0    0    0      0 24 26 34 4
5010=*EOR
```

APPENDIX G

SLAM SUMMARY REPORTS

:

FILE NUMBER	ASSOCIATED RESOURCE	ASSOCIATED ACTIVITY
1	NONE	SLAM event file.
2	NODEPBIL	Permanent Billeting for non-deploying augmentees.
3	RECPOINT	Personnel reception location.
4	INCHECKER	Initial personnel reception and direction.
5	TRABIL	Temporary billeting for deploying personnel.
6	BUS	Transportation to billeting from reception.
7	BILFEED	Feeding capacity in billeting.
8	BUS	Transportation to passenger staging from billeting.
9	PAXSTG	Passenger staging.
10	BUS	Bus to passenger terminal from staging.
11	PAXTERM	Passenger Terminal.
12	PAXAGENT	Passenger Agent.
13	BUS	Transportation to aircraft from passenger terminal.
14	BUS	Transportation to passenger staging from reception point.
15	BUS	Transportation from mobility line to passenger staging.
16	CARGAGNT	Agent to receive, initially inspect unit related cargo.
17	WASHRACK	Vehicle washing location.
18	VEHPROS	Vehicle processing crew/location.
19	VEHPARK	Vehicle marshalling.

FILE NUMBER	ASSOCIATED RESOURCE	ASSOCIATED ACTIVITY
20	JITEAM	Unit related vehicle inspection.
21	WASHRACK	Frustrated vehicle washing.
22	MARSFORK	Forklift to unload unit related cargo from truck.
23	MARSAREA	Pallet marshalling area.
24	JITEAM	Unit related pallet inspection.
25	MARSFORK	Forklift to load unit related cargo on K-loader.
26	MARSFORK	Forklift to move unit related cargo to frustrated cargo area.
27	FRUSTCAR	Frustrated cargo rework area.
28	MARSFORK	Forklift to move unit related cargo from frustrated area to marshallling area.
29	NRCRECPT	Non-unit cargo reception area.
30	NRCAGENT	Non-unit cargo receiving agent.
31	TERMFORK	Forklift to unload non-unit cargo from truck.
32	MARSAREA	Pallet marshalling area.
33	PALTEAM	Palletizing crew for non-unit cargo.
34	TERMFORK	Forklift to load non-unit cargo on K-loader.
35	EXMARS	Explosives marshalling area.
36	PALTEAM	Palletizing crew for explosives.

FILE NUMBER	ASSOCIATED RESOURCE	ASSOCIATED ACTIVITY
37	EXFORK	Forklift to load explosives on K-loader.
38	EXFORK	Forklift to unload explosives from truck.
39	MARSAREA	Pallet marshalling area.
40	BOXLUN	Box lunches for staging and flight.

ESTIMATED RESOURCES

```
100= PASSENGER PERCENTAGE = 1.
110= CARGO PERCENTAGE = .8505873201089
120=
140=                    S L A M   S U M M A R Y   R E P O R T
170=                          SIMULATION PROJECT RECEPTION MODE L        BY G. L. WHITE
190=                          DATE  1/ 7/1983                    RUN NUMBER   1 OF   1
220=                          CURRENT TIME   .7200E+03
230=                          STATISTICAL ARRAYS CLEARED AT TIME  0.
270=                          **FILE STATISTICS**
280=
```

| 290= FILE | ASSOCIATED | AVERAGE | STANDARD | MAXIMUM | CURRENT | AVERAGE |
300= NUMBER	NODE TYPE	LENGTH	DEVIATION	LENGTH	LENGTH	WAITING TIME
320= 1		29.6001	14.4642	491	14	21.7027
330= 2	AWAIT	0.0000	0.0000	0	0	0.0000
340= 3	AWAIT	0.0000	0.0000	1	0	0.0000
350= 4	AWAIT	.0003	.0171	1	0	.0011
360= 5	AWAIT	0.0000	0.0000	1	0	0.0000
370= 6	AWAIT	0.0000	0.0000	1	0	0.0000
380= 7	AWAIT	0.0000	0.0000	1	0	0.0000
390= 8	AWAIT	0.0000	0.0000	1	0	0.0000
400= 9	AWAIT	0.0000	0.0000	1	0	0.0000
410= 10	AWAIT	0.0000	0.0000	0	0	0.0000
420= 11	AWAIT	0.0000	0.0000	1	0	0.0000
430= 12	AWAIT	0.0000	0.0000	1	0	0.0000
440= 13	AWAIT	0.0000	0.0000	1	0	0.0000
450= 14	AWAIT	0.0000	0.0000	1	0	0.0000
460= 15	AWAIT	0.0000	0.0000	1	0	0.0000
470= 16	AWAIT	.0007	.0262	1	0	.0015
480= 17	AWAIT	4.4479	5.8474	20	0	1.3071
490= 18	AWAIT	.0605	.3866	6	0	.0132
500= 19	AWAIT	0.0000	0.0000	1	0	0.0000
510= 20	AWAIT	.7358	2.3717	28	0	.1533
520= 21	AWAIT	.0172	.1311	2	0	.0779
530= 22	AWAIT	0.0000	0.0000	1	0	0.0000
540= 23	AWAIT	0.0000	0.0000	1	0	0.0000
550= 24	AWAIT	5.9007	16.2826	97	0	3.2959
560= 25	AWAIT	0.0000	0.0000	1	0	0.0000
570= 26	AWAIT	0.0000	0.0000	1	0	0.0000
580= 27	AWAIT	0.0000	0.0000	1	0	0.0000
590= 28	AWAIT	0.0000	0.0000	1	0	0.0000
600= 29	AWAIT	0.0000	0.0000	1	0	0.0000
610= 30	AWAIT	.1284	1.4982	37	0	.0535
620= 31	AWAIT	.0006	.0416	6	0	.0003
630= 32	AWAIT	0.0000	0.0000	1	0	0.0000
640= 33	AWAIT	.8554	6.1092	92	0	.3560
650= 34	AWAIT	.0001	.0074	2	0	.0000
660= 35	AWAIT	0.0000	0.0000	1	0	0.0000
670= 36	AWAIT	.0192	.2186	7	0	.0292
680= 37	AWAIT	.1513	1.4856	31	0	.2303
690= 38	AWAIT	.0045	.0667	1	0	.0068
700= 39	AWAIT	0.0000	0.0000	1	0	0.0000
710= 40	AWAIT	0.0000	0.0000	1	0	0.0000

```
760=                          **RESOURCE STATISTICS**
770=
780= RESOURCE  RESOURCE  CURRENT   AVERAGE      STANDARD    MAXIMUM      CURRENT
790= NUMBER    LABEL     CAPACITY  UTILIZATION  DEVIATION   UTILIZATION  UTILIZATION
800=
810=    1      NODEPBIL   1376       0.0000       0.0000         0            0
820=    2      RECPOINT   2000      24.3571      39.7535       243            0
830=    3      INCHECKR      3        .1493        .4215         3            0
840=    4      BUS          26        .2683        .8431        .6            0
850=    5      PAXSTG     2000      33.5558      52.4915       459           15
860=    6      BOXLUN     1000      18.6122      40.9107       459           15
870=    7      BILFEED1   1000     138.8771     169.5237       490            0
880=    8      BILFEED2   1000      38.9491      69.6135       222            0
890=    9      BILFEED3   3000      18.8704      47.5186       201            0
900=   10      TRABIL1     490     139.9279     170.5427       490            0
910=   11      TRABIL2     227      39.1255      69.8213       222            0
920=   12      TRABIL3    3000      19.0028      47.7500       201            0
930=   13      PAXTERM    2000      30.0309      48.2698       353            0
940=   14      PAXAGENT      3        .1166        .3557         3            0
950=   15      CARGAGNT      3        .3012        .5761         3            0
960=   16      WASHRACK      2        .9714        .9837         2            0
970=   17      VEHPROCS      5        .9823       1.3016         5            0
980=   18      VEHPARK    2000     153.2746      82.5240       363          183
990=   19      JITEAM        3       1.3258       1.3517         3            0
1000=  20      MARSAREA   3000     240.3058     218.4783       B35          473
1010=  21      PALTEAM      26       2.5043       6.6114        26           22
1020=  22      EXFORK        6        .2621        .9475         6            0
1030=  23      EXMARS     2000      64.9889     108.5464       342            0
1040=  24      FRUSTCAR    500        .973        2.0793        16            0
1050=  25      MARSFORK      8        .18/4        .5544         8            0
1060=  26      NRCRECPT   2000        .1767       1.8560        41            0
1070=  27      NRCAGENT      4        .0483        .4299         4            0
1080=  28      TERMFORK      8        .1211        .6774         8            0
```

176

```
1100=                         **RESOURCE STATISTICS**
1110=
1120= RESOURCE  RESOURCE  CURRENT    AVERAGE    MINIMUM    MAXIMUM
1130= NUMBER    LABEL     AVAILABLE  AVAILABLE  AVAILABLE  AVAILABL E
1140=
1150=    1      NODEPBIL     1376    1376.0000    1376       1376
1160=    2      RECPOINT     2000    1975.6429    1757       200C
1170=    3      INCHECKR        3       2.8507       0          3
1180=    4      BUS            26      25.7317      20         26
1190=    5      PAXSTG       1985    1966.4442    1541       2000
1200=    6      BOXLUN        985     981.3878     541       1000
1210=    7      BILFEED1     1000     861.1229     510       1000
1220=    8      BILFEED2     1000     961.0509     778       1000
1230=    9      BILFEED3     3000    2981.1296    2799       3000
1240=   10      TRABIL1       490     350.0721       0        490
1250=   11      TRABIL2       227     187.8745       5        227
1260=   12      TRABIL3      3000    2980.9972    2799       3000
1270=   13      PAXTERM      2000    1969.9691    1647       2000
1280=   14      PAXAGENT        3       2.8834       0          3
1290=   15      CARGAGNT        3       2.6988       0          3
1300=   16      WASHRACK        2       1.0286       0          2
1310=   17      VEHPROCS        5       4.0177       0          5
1320=   18      VEHPARK      1817    1846.7254    1637       2000
1330=   19      JITEAM          3       1.6742       0          3
1340=   20      MARSAREA     2527    2759.6942    2165       3000
1350=   21      PALTEAM         4      23.4957       0         26
1360=   22      EXFORK          6       5.7379       0          6
1370=   23      EXMARS       2000    1935.0111    1658       2000
1380=   24      FRUSTCAR      500     499.0262     484        500
1390=   25      MARSFORK        8       7.8126       0          8
1400=   26      NRCRECPT     2000    1999.8233    1959       2000
1410=   27      NRCAGENT        4       3.9517       0          4
1420=   28      TERMFORK        8       7.8789       0          8
1430=*EOR
```

END
DATE
FILMED
11 - 83
DTIC
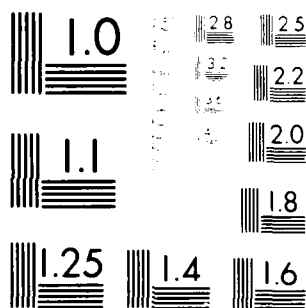
UNLIMITED RESOURCES

```
100= PASSENGER PERCENTAGE = 1.
110= CARGO PERCENTAGE = 1.
120=
140=              S L A M   S U M M A R Y   R E P O R T
170=                     SIMULATION PROJECT RECEPTION MODEL      BY G. L. WHITE
190=                     DATE 1/ 7/1983               RUN NUMBER   1 OF   1
220=                     CURRENT TIME   .7200E+03
230=                     STATISTICAL ARRAYS CLEARED AT TIM E  0.
270=                     **FILE STATISTICS**
280=
```

290= FILE	ASSOCIATED	AVERAGE	STANDARD	MAXIMUM	CURRENT	AVERAGE
300= NUMBER	NODE TYPE	LENGTH	DEVIATION	LENGTH	LENGTH	WAITING TIME
320= 1		29.6001	14.4642	491	14	21.7027
330= 2	AWAIT	0.0000	0.0000	0	0	0.0000
340= 3	AWAIT	0.0000	0.0000	1	0	0.0000
350= 4	AWAIT	0.0000	0.0000	1	0	0.0000
360= 5	AWAIT	0.0000	0.0000	1	0	0.0000
370= 6	AWAIT	0.0000	0.0000	1	0	0.0000
380= 7	AWAIT	0.0000	0.0000	1	0	0.0000
390= 8	AWAIT	0.0000	0.0000	1	0	0.0000
400= 9	AWAIT	0.0000	0.0000	1	0	0.0000
410= 10	AWAIT	0.0000	0.0000	0	0	0.0000
420= 11	AWAIT	0.0000	0.0000	1	0	0.0000
430= 12	AWAIT	0.0000	0.0000	1	0	0.0000
440= 13	AWAIT	0.0000	0.0000	1	0	0.0000
450= 14	AWAIT	0.0000	0.0000	1	0	0.0000
460= 15	AWAIT	0.0000	0.0000	1	0	0.0000
470= 16	AWAIT	0.0000	0.0000	1	0	0.0000
480= 17	AWAIT	0.0000	0.0000	1	0	0.0000
490= 18	AWAIT	0.0000	0.0000	1	0	0.0000
500= 19	AWAIT	0.0000	0.0000	1	0	0.0000
510= 20	AWAIT	0.0000	0.0000	1	0	0.0000
520= 21	AWAIT	0.0000	0.0000	1	0	0.0000
530= 22	AWAIT	0.0000	0.0000	1	0	0.0000
540= 23	AWAIT	0.0000	0.0000	1	0	0.0000
550= 24	AWAIT	0.0000	0.0000	1	0	0.0000
560= 25	AWAIT	0.0000	0.0000	1	0	0.0000
570= 26	AWAIT	0.0000	0.0000	1	0	0.0000
580= 27	AWAIT	0.0000	0.0000	1	0	0.0000
590= 28	AWAIT	0.0000	0.0000	1	0	0.0000
600= 29	AWAIT	0.0000	0.0000	1	0	0.0000
610= 30	AWAIT	0.0000	0.0000	1	0	0.0000
620= 31	AWAIT	0.0000	0.0000	1	0	0.0000
630= 32	AWAIT	0.0000	0.0000	1	0	0.0000
640= 33	AWAIT	0.0000	0.0000	1	0	0.0000
650= 34	AWAIT	0.0000	0.0000	1	0	0.0000
660= 35	AWAIT	0.0000	0.0000	1	0	0.0000
670= 36	AWAIT	0.0000	0.0000	1	0	0.0000
680= 37	AWAIT	0.0000	0.0000	1	0	0.0000
690= 38	AWAIT	0.0000	0.0000	1	0	0.0000
700= 39	AWAIT	0.0000	0.0000	1	0	0.0000
710= 40	AWAIT	0.0000	0.0000	1	0	0.0000

```
760=                          **RESOURCE STATISTICS**
770=
780= RESOURCE   RESOURCE   CURRENT    AVERAGE     STANDARD    MAXIMUM      CURRENT
790= NUMBER     LABEL      CAPACITY   UTILIZATION DEVIATION   UTILIZATION  UTILIZATION
800=
810=     1      NODEPBIL   1376       0.0000      0.0000          0            0
820=     2      RECPOINT   2000       23.7874     39.6374       243            0
830=     3      INCHECKR   100        .1525       .4201           4            0
840=     4      BUS        100        .2607       .8115           6            0
850=     5      PAXSTG     2000       33.6367     52.5933       459           15
860=     6      BOXLUN     1000       18.6116     40.8823       459           15
870=     7      BILFEED1   1000       138.8099    169.4668      490            0
880=     8      BILFEED2   1000       39.6712     70.3036       222            0
890=     9      BILFEED3   3000       18.8157     47.4355       201            0
900=    10      TRABIL1    490        139.7623    170.3784      490            0
910=    11      TRABIL2    227        39.8651     70.5784       222            0
920=    12      TRABIL3    3000       18.9676     47.6909       201            0
930=    13      PAXTERM    2000       30.2391     48.2487       353            0
940=    14      PAXAGENT   100        .1166       .3557           3            0
950=    15      CARGAGNT   100        .2950       .5804           4            0
960=    16      WASHRACK   100        .9823       3.6235         49            0
970=    17      VEHPROCS   100        .9914       2.9047         41            0
980=    18      VEHPARK    2000       201.0457    103.0331      479          187
990=    19      JITEAM     100        1.3308      3.1045         40            0
1000=   20      MARSAREA   3000       240.1031    218.9295      835          473
1010=   21      PALTEAM    100        2.4948      7.7273         81           22
1020=   22      EXFORK     100        .2629       1.1654         20            0
1030=   23      EXMARS     2000       64.8864     108.5441      342            0
1040=   24      FRUSTCAR   500        .9706       2.0779         18            0
1050=   25      MARSFORK   100        .1893       .5569           7            0
1060=   26      NRCRECPT   2000       .0480       1.0392         41            0
1070=   27      NRCAGENT   100        .0480       1.0392         41            0
1080=   28      TERMFORK   100        .1219       1.1529         41            0
```

```
1100=                        **RESOURCE STATISTICS**
1110=
1120= RESOURCE  RESOURCE  CURRENT    AVERAGE    MINIMUM    MAXIMUM
1130= NUMBER    LABEL     AVAILABLE  AVAILABLE  AVAILABLE  AVAILABLE
1140=
1150=    1      NODEPBIL    1376     1376.0000    1376       1376
1160=    2      RECPOINT    2000     1976.2126    1757       2000
1170=    3      INCHECKR     100       99.8475      96        100
1180=    4      BUS          100       99.7393      94        100
1190=    5      PAXSTG      1985     1966.3633    1541       2000
1200=    6      BOXLUN       985      981.3884     541       1000
1210=    7      BILFEED1    1000      861.1901     510       1000
1220=    8      BILFEED2    1000      960.3288     778       1000
1230=    9      BILFEED3    3000     2981.1843    2799       3000
1240=   10      TRABIL1      490      350.2377       0        490
1250=   11      TRABIL2      227      187.1349       5        227
1260=   12      TRABIL3     3000     2981.0324    2799       3000
1270=   13      PAXTERM     2000     1969.7609    1647       2000
1280=   14      PAXAGENT     100       99.8834      97        100
1290=   15      CARGAGNT     100       99.7050      96        100
1300=   16      WASHRACK     100       99.0177      51        100
1310=   17      VEHPROCS     100       99.0086      59        100
1320=   18      VEHPARK     1813     1798.9543    1521       2000
1330=   19      JITEAM       100       98.6692      60        100
1340=   20      MARSAREA    2527     2759.8969    2165       3000
1350=   21      PALTEAM       78       97.5052      19        100
1360=   22      EXFORK       100       99.7371      80        100
1370=   23      EXMARS      2000     1935.1136    .1658      2000
1380=   24      FRUSTCAR     500      499.0294     482        500
1390=   25      MARSFORK     100       99.8107      93        100
1400=   26      NRCRECPT    2000     1999.9520    1959       2000
1410=   27      NRCAGENT     100       99.9520      59        100
1420=   28      TERMFORK     100       99.8781      59        100
1430=*EOR
```

RECOMMENDED RESOURCES

```
100= PASSENGER PERCENTAGE = 1.
110= CARGO PERCENTAGE = .9557821485527
120=
140=               S L A M   S U M M A R Y   R E P O R T
170=               SIMULATION PROJECT RECEPTION MODEL        BY G. L. WHITE
190=               DATE  1/ 7/1983               RUN NUMBER   1 OF   1
220=               CURRENT TIME    .7200E+03
230=               STATISTICAL ARRAYS CLEARED AT TIME  0.
270=               **FILE STATISTICS**
280=
```

290= FILE	ASSOCIATED	AVERAGE	STANDARD	MAXIMUM	CURRENT	AVERAGE
300= NUMBER	NODE TYPE	LENGTH	DEVIATION	LENGTH	LENGTH	WAITING TIME
320= 1		29.6001	14.4642	491	14	21.7027
330= 2	AWAIT	0.0000	0.0000	0	0	0.0000
340= 3	AWAIT	0.0000	0.0000	1	0	0.0000
350= 4	AWAIT	.0003	.0169	1	0	.0011
360= 5	AWAIT	0.0000	0.0000	1	0	0.0000
370= 6	AWAIT	0.0000	0.0000	1	0	0.0000
380= 7	AWAIT	0.0000	0.0000	1	0	0.0000
390= 8	AWAIT	0.0000	0.0000	1	0	0.0000
400= 9	AWAIT	0.0000	0.0000	1	0	0.0000
410= 10	AWAIT	0.0000	0.0000	0	0	0.0000
420= 11	AWAIT	0.0000	0.0000	1	0	0.0000
430= 12	AWAIT	0.0000	0.0000	1	0	0.0000
440= 13	AWAIT	0.0000	0.0000	1	0	0.0000
450= 14	AWAIT	0.0000	0.0000	1	0	0.0000
460= 15	AWAIT	0.0000	0.0000	1	0	0.0000
470= 16	AWAIT	.0002	.0145	1	0	.0005
480= 17	AWAIT	4.4145	5.8218	20	0	1.2973
490= 18	AWAIT	.0623	.3977	6	0	.0135
500= 19	AWAIT	0.0000	0.0000	1	0	0.0000
510= 20	AWAIT	.2188	.9767	13	0	.0455
520= 21	AWAIT	.0143	.1211	2	0	.0703
530= 22	AWAIT	0.0000	0.0000	1	0	0.0000
540= 23	AWAIT	0.0000	0.0000	1	0	0.0000
550= 24	AWAIT	1.1375	5.8984	58	0	.6305
560= 25	AWAIT	0.0000	0.0000	1	0	0.0000
570= 26	AWAIT	0.0000	0.0000	1	0	0.0000
580= 27	AWAIT	0.0000	0.0000	1	0	0.0000
590= 28	AWAIT	0.0000	0.0000	1	0	0.0000
600= 29	AWAIT	0.0000	0.0000	1	0	0.0000
610= 30	AWAIT	.1288	1.5008	37	0	.0536
620= 31	AWAIT	.0004	.0250	3	0	.0002
630= 32	AWAIT	0.0000	0.0000	1	0	0.0000
640= 33	AWAIT	2.8602	13.0750	145	4	1.1904
650= 34	AWAIT	.0000	.0067	1	0	.0000
660= 35	AWAIT	0.0000	0.0000	1	0	0.0000
670= 36	AWAIT	.0377	.2674	5	0	.0574
680= 37	AWAIT	.1492	1.4226	26	0	.2271
690= 38	AWAIT	.0045	.0669	1	0	.0068
700= 39	AWAIT	0.0000	0.0000	1	0	0.0000
710= 40	AWAIT	0.0000	0.0000	1	0	0.0000

```
1100=                        **RESOURCE STATISTICS**
1110=
1120= RESOURCE  RESOURCE   CURRENT    AVERAGE     MINIMUM     MAXIMUM
1130= NUMBER    LABEL      AVAILABLE  AVAILABLE   AVAILABLE   AVAILABL E
1140=
1150=    1      NODEPBIL    1376      1376.0000    1376        1376
1160=    2      RECPOINT    2000      1976.3246    1757        2000
1170=    3      INCHECKR       3         2.8486       0           3
1180=    4      BUS           26        25.7242      20          26
1190=    5      PAXSTG      1985      1966.4389    1647        2000
1200=    6      BOXLUN       985       981.3889     541        1000
1210=    7      BILFEED1    1000       861.1564     510        1000
1220=    8      BILFEED2    1000       960.3324     778        1000
1230=    9      BILFEED3    3000      2981.1154    2799        3000
1240=   10      TRABIL1      490       350.1176       0         490
1250=   11      TRABIL2      227       187.0985       5         227
1260=   12      TRABIL3     3000      2980.9993    2799        3000
1270=   13      PAXTERM     2000      1970.0601    1647        2000
1280=   14      PAXAGENT       3         2.8834       0           3
1290=   15      CARGAGNT       3         2.7009       0           3
1300=   16      WASHRACK       2         1.0357       0           2
1310=   17      VEHPROCS       5         4.0201       0           5
1320=   18      VEHPARK     1825      1849.7923    1632        2000
1330=   19      JITEAM         4         2.6743       0           4
1340=   20      MARSAREA    2527      2760.1609    2165        3000
1350=   21      PALTEAM        0        15.4997       0          22
1360=   22      EXFORK         6         5.7367       0           6
1370=   23      EXMARS      2000      1935.0292    1658        2000
1380=   24      FRUSTCAR     500       498.9841     482         500
1390=   25      MARSFORK       8         7.8091       2           8
1400=   26      NRCRECPT    2000      1999.8230    1959        2000
1410=   27      NRCAGENT       4         3.9518       0           4
1420=   28      TERMFORK       8         7.8789       0           8
1430=*EOR
```

```
760=                                    **RESOURCE STATISTICS**
770=
780= RESOURCE  RESOURCE  CURRENT   AVERAGE      STANDARD    MAXIMUM      CURRENT
790= NUMBER    LABEL     CAPACITY  UTILIZATION  DEVIATION   UTILIZATION  UTILIZATION
800=
810=     1     NODEPBIL   1376      0.0000        0.0000         0            0
820=     2     RECPOINT   2000     23.6754       39.3922       243           0
830=     3     INCHECKR      3       .1514         .4233         3           0
840=     4     BUS          26       .2758         .8383         6           0
850=     5     PAXSTG     2000     33.5611       52.3836       353          15
860=     6     BOXLUN     1000     18.6111       40.9763       459          15
870=     7     BILFEED1   1000    138.8436      169.5595       490           0
880=     8     BILFEED2   1000     39.6676       70.3313       222           0
890=     9     BILFEED3   3000     18.8846       47.5921       201           0
900=    10     TRABIL1     490    139.8824      170.5502       490           0
910=    11     TRABIL2     227     39.9015       70.6245       222           0
920=    12     TRABIL3    3000     19.0007       47.7996       201           0
930=    13     PAXTERM    2000     29.9399       49.1793       353           0
940=    14     PAXAGENT      3       .1166         .3557         3           0
950=    15     CARGAGNT      3       .2991         .5704         3           0
960=    16     WASHRACK      2       .9643         .9832         2           0
970=    17     VEHPROCS      5       .9799        1.3065         5           0
980=    18     VEHPARK    2000    150.2077       82.1195       368         175
990=    19     JITEAM        4      1.3257        1.5284         4           0
1000=   20     MARSAREA   3000    239.8391      218.8314       835         473
1010=   21     PALTEAM      22      2.5003        5.8080        22          22
1020=   22     EXFORK        6       .2633         .9479         6           0
1030=   23     EXMARS     2000     64.9708      108.4994       342           0
1040=   24     FRUSTCAR    500      1.0159        2.1335        18           0
1050=   25     MARSFORK      8       .1909         .5561         7           0
1060=   26     NRCRECPT   2000       .1770        1.8586        41           0
1070=   27     NRCAGENT      4       .0482         .4293         4           0
1080=   28     TERMFORK      8       .1211        ..6781         8           0
```

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APPENDIX H

STATISTICAL ANALYSIS

GROUP 1: AVERAGE .9580
JOINT INSPECTION TEAMS: 4
PALLETIZING CREWS: 26

```
GROUP 1 RUN 1  = .9744
GROUP 1 RUN 2  = .9718
GROUP 1 RUN 3  = .9434
GROUP 1 RUN 4  = .9751
GROUP 1 RUN 5  = .9452
GROUP 1 RUN 6  = .9698
GROUP 1 RUN 7  = .9328
GROUP 1 RUN 8  = .9516
GROUP 1 RUN 9  = .9655
GROUP 1 RUN 10 = .9508
```

GROUP 2: AVERAGE .9841
JOINT INSPECTION TEAMS: 5
PALLETIZING CREWS: 26
```
GROUP 2 RUN 1  = .9801
GROUP 2 RUN 2  = .9846
GROUP 2 RUN 3  = .9899
GROUP 2 RUN 4  = .9894
GROUP 2 RUN 5  = .984
GROUP 2 RUN 6  = .9851
GROUP 2 RUN 7  = .9786
GROUP 2 RUN 8  = .9884
GROUP 2 RUN 9  = .9825
GROUP 2 RUN 10 = .9789
```

GROUP 3: AVERAGE .8342
JOINT INSPECTION TEAMS: 3
PALLETIZING CREWS: 26

```
GROUP 3 RUN 1  = .6841
GROUP 3 RUN 2  = .8858
GROUP 3 RUN 3  = .8718
GROUP 3 RUN 4  = .8424
GROUP 3 RUN 5  = .9049
GROUP 3 RUN 6  = .8326
GROUP 3 RUN 7  = .8464
GROUP 3 RUN 8  = .8533
GROUP 3 RUN 9  = .8369
GROUP 3 RUN 10 = .7839
```

```
GROUP 4: AVERAGE .1959
JOINT INSPECTION TEAMS: 2
PALLETIZING CREWS: 26
  GROUP 4 RUN 1  = .2654
  GROUP 4 RUN 2  = .1854
  GROUP 4 RUN 3  = .1839
  GROUP 4 RUN 4  = .1949
  GROUP 4 RUN 5  = .2234
  GROUP 4 RUN 6  = .1718
  GROUP 4 RUN 7  = .1485
  GROUP 4 RUN 8  = .2093
  GROUP 4 RUN 9  = .1665
  GROUP 4 RUN 10 = .2097


GROUP 5: AVERAGE .9644
JOINT INSPECTION TEAMS: 4
PALLETIZING CREWS: 22
  GROUP 5 RUN 1  = .9577
  GROUP 5 RUN 2  = .9617
  GROUP 5 RUN 3  = .9698
  GROUP 5 RUN 4  = .9605
  GROUP 5 RUN 5  = .9746
  GROUP 5 RUN 6  = .9792
  GROUP 5 RUN 7  = .9491
  GROUP 5 RUN 8  = .9708
  GROUP 5 RUN 9  = .9472
  GROUP 5 RUN 10 = .9547


GROUP 6: AVERAGE .9602
JOINT INSPECTION TEAMS: 4
PALLETIZING CREWS: 18
  GROUP 6 RUN 1  = .9517
  GROUP 6 RUN 2  = .9636
  GROUP 6 RUN 3  = .9774
  GROUP 6 RUN 4  = .9561
  GROUP 6 RUN 5  = .933
  GROUP 6 RUN 6  = .963
  GROUP 6 RUN 7  = .9593
  GROUP 6 RUN 8  = .9718
  GROUP 6 RUN 9  = .9716
  GROUP 6 RUN 10 = .9545
```

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```
GROUP 7: AVERAGE .9482
JOINT INSPECTION TEAMS: 4
PALLETIZING CREWS: 14
 GROUP 7 RUN 1 = .9515
 GROUP 7 RUN 2 = .9546
 GROUP 7 RUN 3 = .9635
 GROUP 7 RUN 4 = .9562
 GROUP 7 RUN 5 = .9567
 GROUP 7 RUN 6 = .9664
 GROUP 7 RUN 7 = .933
 GROUP 7 RUN 8 = .9345
 GROUP 7 RUN 9 = .9437
 GROUP 7 RUN 10 = .9216



GROUP 8: AVERAGE .9095
JOINT INSPECTION TEAMS: 4
PALLETIZING CREWS: 10
 GROUP 8 RUN 1 = .9271
 GROUP 8 RUN 2 = .9118
 GROUP 8 RUN 3 = .9211
 GROUP 8 RUN 4 = .9086
 GROUP 8 RUN 5 = .9074
 GROUP 8 RUN 6 = .8869
 GROUP 8 RUN 7 = .9135
 GROUP 8 RUN 8 = .901
 GROUP 8 RUN 9 = .9214
 GROUP 8 RUN 10 = .8944



GROUP 9: AVERAGE .5082
SENSITIVITY ANALYSIS
JOINT INSPECTION TEAMS: 4
PALLETIZING CREWS: 18
 GROUP 9 RUN 1 = .5375
 GROUP 9 RUN 2 = .6495
 GROUP 9 RUN 3 = .3194
 GROUP 9 RUN 4 = .51
 GROUP 9 RUN 5 = .5111
 GROUP 9 RUN 6 = .3374
 GROUP 9 RUN 7 = .642
 GROUP 9 RUN 8 = .5947
 GROUP 9 RUN 9 = .3885
 GROUP 9 RUN 10 = .5914
```

GROUP 1 RUN 1 = 76		GROUP 4 RUN 1 = 10
GROUP 1 RUN 2 = 74.5		GROUP 4 RUN 2 = 5
GROUP 1 RUN 3 = 46		GROUP 4 RUN 3 = 4
GROUP 1 RUN 4 = 78		GROUP 4 RUN 4 = 6
GROUP 1 RUN 5 = 48		GROUP 4 RUN 5 = 9
GROUP 1 RUN 6 = 70.5		GROUP 4 RUN 6 = 3
GROUP 1 RUN 7 = 42		GROUP 4 RUN 7 = 1
GROUP 1 RUN 8 = 53		GROUP 4 RUN 8 = 7
GROUP 1 RUN 9 = 68		GROUP 4 RUN 9 = 2
GROUP 1 RUN 10 = 51		GROUP 4 RUN 10 = 8
GROUP 1 MEAN = 60.7		GROUP 4 MEAN = 5.5
GROUP 2 RUN 1 = 83		GROUP 5 RUN 1 = 61
GROUP 2 RUN 2 = 86		GROUP 5 RUN 2 = 64
GROUP 2 RUN 3 = 90		GROUP 5 RUN 3 = 70.5
GROUP 2 RUN 4 = 89		GROUP 5 RUN 4 = 63
GROUP 2 RUN 5 = 85		GROUP 5 RUN 5 = 77
GROUP 2 RUN 6 = 87		GROUP 5 RUN 6 = 82
GROUP 2 RUN 7 = 80		GROUP 5 RUN 7 = 50
GROUP 2 RUN 8 = 88		GROUP 5 RUN 8 = 72
GROUP 2 RUN 9 = 84		GROUP 5 RUN 9 = 49
GROUP 2 RUN 10 = 81		GROUP 5 RUN 10 = 57
GROUP 2 MEAN = 85.3		GROUP 5 MEAN = 64.55
GROUP 3 RUN 1 = 21		GROUP 6 RUN 1 = 54
GROUP 3 RUN 2 = 29		GROUP 6 RUN 2 = 67
GROUP 3 RUN 3 = 28		GROUP 6 RUN 3 = 79
GROUP 3 RUN 4 = 25		GROUP 6 RUN 4 = 58
GROUP 3 RUN 5 = 33		GROUP 6 RUN 5 = 43.5
GROUP 3 RUN 6 = 23		GROUP 6 RUN 6 = 65
GROUP 3 RUN 7 = 26		GROUP 6 RUN 7 = 62
GROUP 3 RUN 8 = 27		GROUP 6 RUN 8 = 74.5
GROUP 3 RUN 9 = 24		GROUP 6 RUN 9 = 73
GROUP 3 RUN 10 = 22		GROUP 6 RUN 10 = 55
GROUP 3 MEAN = 25.8		GROUP 6 MEAN = 63.1

```
GROUP 7 RUN  1 =  52
GROUP 7 RUN  2 =  56
GROUP 7 RUN  3 =  66
GROUP 7 RUN  4 =  59
GROUP 7 RUN  5 =  60
GROUP 7 RUN  6 =  69
GROUP 7 RUN  7 =  43.5
GROUP 7 RUN  8 =  45
GROUP 7 RUN  9 =  47
GROUP 7 RUN 10 =  40
GROUP 7 MEAN =   53.75

GROUP 8 RUN  1 =  41
GROUP 8 RUN  2 =  36
GROUP 8 RUN  3 =  38
GROUP 8 RUN  4 =  35
GROUP 8 RUN  5 =  34
GROUP 8 RUN  6 =  30
GROUP 8 RUN  7 =  37
GROUP 8 RUN  8 =  32
GROUP 8 RUN  9 =  39
GROUP 8 RUN 10 =  31
GROUP 8 MEAN =   35.3

GROUP 9 RUN  1 =  16
GROUP 9 RUN  2 =  20
GROUP 9 RUN  3 =  11
GROUP 9 RUN  4 =  14
GROUP 9 RUN  5 =  15
GROUP 9 RUN  6 =  12
GROUP 9 RUN  7 =  19
GROUP 9 RUN  8 =  18
GROUP 9 RUN  9 =  13
GROUP 9 RUN 10 =  17
GROUP 9 MEAN =   15.5
```

HYPOTHESIS TEST USING KRUSKAL-WALLIS TEST STATISTIC

H_o: The means of group A and B are the same.
H_a: The means of group A and B are different.

Reject H_o if $T_H > H$.

  = .10
H = 29.66395

T_H values between groups

Group 1	2	3	4	5	6	7	8	9
1	24.6	34.9*	55.2*	3.8	2.4	7.0	25.4	45.2*
2		59.5*	79.8*	20.8	22.2	31.6*	50.0*	69.8*
3			20.3	38.8*	37.3*	28.0	9.5	10.3
4				59.0*	57.6*	48.2*	29.8*	10.0
5					1.4	10.8	29.2	49.1*
6						9.4	27.8	47.6*
7							18.4	38.2*
8								19.2

* indicates the null hypothesis is rejected and there is significant difference between the means of groups A and B.

```
10 DIM D(10,10):DIM M(10):DIM F(10):DIM G(10)
20 N=9
30 FOR A=1TON
40 FOR B=1TO10
50 READ D(A,B)
60 PRINT#-2,"GROUP";A;"RUN"B;"=";D(A,B)
70 IF B=10 THEN PRINT#-2
80 NEXT B
90 NEXT A
100 FOR R=1TO90
110 X=1
120 FOR C=1TON
130 FOR E=1TO10
140 IF D(C,E)=X THEN GOTO 170
150 IF D(C,E)<X THEN GOTO 160ELSE180
160 RP=1:X=D(C,E):F(RP)=C:G(RP)=E:GOTO180
170 RP=RP+1:F(RP)=C:G(RP)=E
180 NEXT E
190 NEXT C
200 FOR Q=1TORP
210 Z=Z+1
220 ZT=ZT+Z
230 NEXT Q
240 ZM=ZT/RP
250 FOR Q=1TORP
260 D(F(Q),G(Q))=ZM
270 NEXT Q
280 ZT=0
290 IF Z=90 THEN GOTO 310
300 NEXTR
310 FOR A=1TON
320 FOR B=1TO10
330 S=D(A,B)+S
340 PRINT#-2,"GROUP";A;"RUN";B;"=";D(A,B)
350 IF B=10 THEN 360 ELSE 380
360 PRINT#-2,"GROUP";A;"MEAN = ";S/10:PRINT#-2
370 M(A)=S/10:S=0
380 NEXT B
```

```
390 NEXT A
400 H=2.539*(N*(N*10+1)/6)^.5
410 PRINT#-2:PRINT#-2,"H = ";H:PRINT#-2
420 PRINT#-2,"GOUPING TESTS"
430 FOR A=1TON
440 FOR B=1TON
450 IF B<=A THEN 510
460 S=ABS(M(A)-M(B))
470 PRINT#-2,"TEST STATISTIC FOR GROUP";A;" - ";B" = ";S
480 IF S>H THEN PRINT#-2,"GROUP";B;"DIFFERS SIGNIFICANTLY
 FROM GROUP";A
490 IF S<=H THEN PRINT#-2,"GROUP"B;"DOES NOT DIFFER FROM
GROUP";A
500 PRINT#-2
510 NEXTB
520 NEXTA
530 DATA .9744,.9718,.9434,.9751,.9452,.9698,.9328,.9516,
.9655,.9508
540 DATA .9801,.9846,.9899,.9894,.9840,.9851,.9786,.9884,
.9825,.9789
550 DATA .6841,.8858,.8718,.8424,.9049,.8326,.8464,.8533,
.8369,.7839
560 DATA .2654,.1854,.1839,.1949,.2234,.1718,.1485,.2093,
.1665,.2097
570 DATA .9577,.9617,.9698,.9605,.9746,.9792,.9491,.9708,
.9472,.9547
580 DATA .9517,.9636,.9774,.9561,.9330,.9630,.9593,.9718,
.9716,.9545
590 DATA .9515,.9546,.9635,.9562,.9567,.9664,.9330,.9345,
.9437,.9216
600 DATA .9271,.9118,.9211,.9086,.9074,.8869,.9135,.9010,
.9214,.8944
610 DATA .5375,.6495,.3194,.5100,.5111,.3374,.6420,.5947,
.3885,.5914
```

APPENDIX I

USER'S MANUAL

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USER'S MANUAL

This manual provides a summary of APOE reception model concepts and the program development. The following line by line analysis of the programed system parameters and resources should help mobility planners who are unfamiliar with SLAM and FORTRAN languages to experiment with the model.

MODEL CONCEPTS

The SLAM model inputs entities into the system, which flow through various activities. Entity attributes identify particular entities and direct their course through the system activities. Activities represent various time delays such as transportation or servicing times. Most activities require resources, such as buses, forklifts, or palletization crews. If an entitiy is scheduled for an activity and the required resource is not available, the entity enters a queue until the resource becomes available. Entities within a queue may be prioritized to receive the next available resource. Additionally, separate queues drawing upon the same resource may be prioritized. A planner may desire to experiment with the system by changing priorities within or between queues.

For this model, a personnel entity represents the

total group of people associated with a particular FRN. The number of people in the group is maintained in Attribute 3. A cargo entity represents one pallet of cargo or one vehicle. The average weight of a pallet or a vehicle may be modified by the modeler. Adjusting the average vehicle or pallet weight will change the number of entities entering the system and subsuquent demand of resources since the number of pallets or vehicles is determined by dividing the total weight by the average weight.

In addition to server resources, this model considers space resources such as billeting, marshalling area, vehicle parking area, and others. For this simulation area resources were set artificially high to indicate maximum entity demand for a particular area. This approach provides a planner with sizing figures. If the modeler elects to use space resources which are less than the demand, personnel or cargo will queue, preventing them from flowing onto subsequent activities until the required resource is available.

Activity duration may be determined by two means, global XX(.) variables or user function distribution subroutines. A global variable represents a set, predetermined or calculated value which can be referenced or used throughout the system. For example, XX(3) = 12, (Line 2260) means that every time XX(3) is referenced or

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called in the simulation, the number 12 is used. A user function, however, will return different numbers conforming to a defined distribution or arithmetic operation each time it is referenced or called. For this simulation, activities which are generally base-specific such as transportation times between different locations are represented with global variables. More universal type activities such as the time to build a pallet or inspect a vehicle are represented with distribtuions. This allows a planner to easily modify this model to different APOEs. Planners can experiment with the system by changing either global or user function activity times.

Finally, when the entity departs the system, SLAM collects statistics. The departing personnel and cargo are totalled and the final average ratio of on-time to total departing personnel and cargo is returned at the end of the selected simulation period. Additionally, SLAM collects resource and queue statistics and summarizes this information. Appendix G contains a 30 day SLAM summary for the simulated TPFDD. Volume II contains actual classified 30 day summaries. The resource usage graphs in Volume II are obtained from 30 daily SLAM summaries. SLAM also allows the flexibilty in collecting statistics so that the planner may experiment with the system by collecting data over various specific periods of time (eg. from day 7 to day 12).

PROGRAM DEVELOPMENT

The simulation program consists of a SLAM network
and user written FORTRAN subroutines. The SLAM network
identifies the time duration for the simulation, desired
SLAM statistic collection, queue prioritization, resource
definition, and the actual activity network. The FORTRAN
subroutines are divided into event routines, initializa-
tion routines, user functions, and allocation routines.
The event routines read the input data, generate entities
with appropriate attributes, and schedule entity arri-
vals. The initialization routine allows the user to set
desired values for the XX(.) global variables. The user
function subroutines define distribtuions or arithmetic
operations and return the resulting values. The alloca-
tion subroutine is used to assign billeting, buses, or
break bulk cargo into single pallet or vehicle entities.
System experimentation should be limited to adjusting
arrival or departure concepts in the event subroutine,
changing global variable initial values, or changing dis-
tribution parameters in the user functions since further
changes require an in depth understanding of SLAM and
FORTRAN.

PROGRAM ANALYSIS

DATA PREPARATION

The program requires nine data entries for each FRN.
The data cards must be generated with the data entered as
integers in the following order: bulk tons, over-size
tons, out-size tons, number of passengers, explosive tons,
ALD, EAD, LAD, type. The tons should be indicated in
short tons, and the ALD, EAD, and LAD expressed as C+O
day. The type codes are: 1 for non-deploying, 2 for unit
related off-base, 3 for non-unit related off-base, 4 for
unit related on-base, and 5 for non-unit related on-base.
The Fortran data read statements are formated so the data
must be in the exact format as the data presented in Vol-
ume II. A single space must preceed the bulk tons entry
on each card. The data cards may be generated by hand-
punching information extracted from the TPFDD or by a
WWMCCS generated tape.

SLAM NETWORK

All line number and value references relate to the
SLAM network listed in Appendix E.

Line 100 and 110 should not be changed.

To collect daily summaries rather than a 30 day
summary add lines:

114= MONTR,SUMRY,24.0,24.0;

118= MONTR,CLEAR,24.0,24.0;

Lines 130 through 180 establish entitiy priority
within the queues. For example, for 18,LVF(2)/, on Line
140 the 18 represents the await file number, LVF indicates
lowest value first, and the (2) means look at attribute 2
for the lowest value. For the 18,LVF(2)/ example, for all
the queued entities in file 18 (awaiting washrack) the ve-
hicle with the lowest attribute 2 value (scheduled depar-
ture time) would be selected first for the next available
washrack. The file number associated with a queue can be
obtained from the small number in the await node in the
SLAM flowchart (Figure I-1), or from the network resource

Figure I-1

lines (Lines 200 through 750), or from the await node
glossary in Appendix G or Volume II. In this program,
await files 2 through 8 default to a first-in-first-out
priority. All other queues are prioritized to select the
entity with the nearest departure time. The user may
change the priority to last-in-first-out by changing LVF
to LIFO. A highest value priority is designated with the

letters HVF rather than LVF. To change the prioritizing attribute, change the number in the parenthesis to correspond to the desired attribute number.

Lines 200 through 750 define resource levels. The number in parenthesis indicates the defined resource levels initially available. The number following the parenthesis identifies which await files or queues are associated with this resource. Where more than one queue is associated with a resource, the order of the queue numbers determines the priority between the queues. For example, line 260 represents the bus resources. Three buses are initially available. Await queues 13, 10, 8, 6, 15, and 14 all require buses. If only one bus is available and all the queues have entities needing a bus those in queue 13 would have priority and the particular entity with the lowest value in attribute 2 would get the bus. If await file 13 is empty then await file 10 would have the next highest priority. The general philosophy in this model assigns queue priority to the queues associated with activities closest to departure.

In this model, resources are designated essential or non-essential. Essential resources will force the entity to enter a queue and wait for the resource to become available. For non-essential resources such as feeding in billeting a shortage will not prevent the entity from progressing through the system. For billeting shortages

entities would queue until receiving billeting, or until time to proceed to passenger staging. At this time they would depart the billeting queue and proceed through the network.

An explanation of the composition of each resource by line further defines this model.

200= NODEPBIL, represents permanent billeting for non-deploying personnel. Each number represents a bed for one person.

220= RECPOINT, is a general area to initially receive personnel and direct them to the appropriate area.

240= INCHECKER, is a person who initially receives personnel, checks their unit identification and directs them to the appropriate area.

260= BUS, is base supplied transportation to billeting, passenger staging, the aircraft etc. All buses in this model will carry 40 passengers.

280= PAXSTG, is a location where units can assemble for briefings before proceeding to the passenger terminal. Each number represents space for one person.

300= BOXLUN, is a box lunch which each passenger will receive in passenger staging and upon leaving the passenger terminal. The simulation collects the number of lunches required each hour.

320 through 360 represents feeding while in billeting. This could be additional box lunches, or hot meals.

Each number represents one meal and each person will require three meals per day. These requirements do not use BOXLUN resources from line 300.

380 and 400 represent on base temporary billeting. Each number represents a bed for one person. TRABIL1 has priority over and will be filled before using TRABIL2.

420 represents billeting overflow. TRABIL3 will not be used unless TRABIL1 and TRABIL2 are full. TRABIL3 may be off-base contract quarters or tents.

440= PAXTERM, represents space for one person in the passenger terminal.

460= PAXAGENT, is an individual who will perform final passenger briefings, anti-hijacking and other final terminal responsibilities. One passenger agent will brief an entire FRN.

480= CARGAGNT, is a person who initially receives and examines the cargo paperwork and directs the cargo to the appropriate unloading area.

500= WASHRACK is a location to wash vehicles. Each vehicle needs one washrack if washing is required.

520= VEHPROCS, is the area and personnel who inspect, weigh, stencil, drain and purge vehicles if required.

540= VEHPARK, is parking space for vehicle awaiting departure. Each number represents space for one vehicle.

560= JITEAM, is a team representing the shipper, APOE, and the aircrew. For this simultion Phase II load-

ing is assumed, so each joint inspection team will include

a qualified loadmaster. This allows cargo inspection as

soon as the team is ready, rather than the shipper and

APOE waiting for the aircrew to arrive before beginning

inspection.

580= MARSAREA is the marshalling area for unit and

non-unit related cargo. Cargo requires marshalling area

as soon as it is unloaded from the truck. Each number

represents space for one pallet.

600= PALTEAM, is a palletizing team. For this sim-

ulation a palletizing team represents qualified loaders

with a forklift and a rotating inspector to correct defi-

ciencies on the spot. After the pallet is built the in-

spector insures it is airworthy and the team then moves it

to final marshalling.

620= EXFORK, are forklifts in the explosive marshal-

ling area to unload trucks and load K-loaders.

640= EXMARS, is the explosive marshalling area. Each

number is space for one pallet.

660= FRUSTCAR, is a location where unit-related pal-

lets can be broken down and reworked. Each number repre-

sents space for one pallet.

680= MARSFORK, is a forklift to unload trucks and

load K-Loaders in the marshalling area.

700= NRCECPT, is an area to receive non-unit related

cargo. All this cargo will require palletization. Each

number represents one pallet's worth of cargo.

720= NRCAGENT, is an individual who receives non-unit cargo, inspects accompanying paperwork, and directs the cargo to its processing area.

740= TERMFORK, is a forklift in the cargo terminal area used to unload non-unit related cargo.

Lines 770 through 4370 are the system network. Without an understanding of SLAM do not change these lines.

Line 4390 determines the simulation duration. The first number is the start time and the second number is the finish time. For this simulation the simulation ran from hour 0 to hour 720 (30 days).

FORTRAN SUBROUTINES

Do not change any line in the main program, line 100 through 290.

The event subroutine (line 340 through 1980) should be changed only to modify the FRN arrival or departure scheduling. The arrival time, stored in attribute 1 is calculated in line 680 through 700. For this simulation the arrivals are determined from the TPFDD ALD. A 24 hour arrival window defined by 0000 hours to 2400 hours is established. From this window the arrival time is drawn from an uniform distribution. The departure time is calculated in lines 730 through 780. More factors are

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involved in establishing a realistic departure time than in determining the arrival time. First the departure time must be at least the arrival time plus a minimum time for APOE processing (Line 730). For a very large FRN the APOE will require more time to process it, so this preparation time is considered in Line 740. The cargo should not depart the APOE to arrive at the POD prior to the EAD so this situation is accounted for in Line 760. Line 770 selects the highest of these three values which represents the very earliest the FRN could depart. The latest departure parameter is the latest the FRN could depart the APOE and still arrive at the POD by 2400 hours on the LAD. These two values define a window of time from the earliest possible to the latest allowable departure time. From this window the actual departure time is drawn from a uniform distribution.

Lines 780 through 910 assign attributes and manipulate SLAM files.

Another modification a user might consider is the vehicle/pallet mixture. Lines 920 through 960 are two switched vehicle computation methods. If $XX(52) = 1$, 75% of unit related and 10% of non-unit related cargo is considered vehicular. The user may change these percentages in Lines 920 and 930. If $XX(52) = 0$, all outsized and oversized cargo are considered vehicles and all bulk cargo is considered pallets.

The initialization subroutine (Lines 2030 through 4030) sets the values for all the global variables. In this section each variable is explained in the code followed by the value. The user may change any of the XX(.) values as desired.

The user function subroutines (Lines 4100 through 8780) return various values to the SLAM network. Each user function is documented in the code. The user may change any arithmetic operation or distribtuion as desired. All the distributions are triangular distributions, with three parameters. The triangular distributions are identified TRIAG(X1,X2,X3,X4), where X1 is the shortest time to accomplish an activity, X2 the most likely time, and X3 the longest time. X4 identifies the random number stream and should be left at 2. X1, X2, X3 must be real numbers. The program will not run if integer values are used as distribtuion parameters.

User functions 6, 7, (Lines 4900 through 5020) 38, and 39 (Lines 8550 through 8670) collect on-time statistics as personnel and cargo depart. The functions collect an average rate over the entire simulation run. To collect on-time rates for specific days these functions must be modified. Specific modifications depend on the user's desired statistic to be collected and require an understanding of FORTRAN programing, so will not be detailed in this manual.

The allocation subroutines (Line 8800 through 11730) assigns buses, assigns billeting and separates the FRN cargo into individual pallets and vehicles. Subroutine "otput" (Line 11770 through 11900) prints the on-time percentages at the simulation conclusion. The user should not modify the the allocation or "otput" subroutines.

COMPUTER REQUIREMENTS

To input this program to the computer the user must generate three separate files. The first file is the FORTRAN code, the second file is the SLAM network, and the third file is the data. The SLAM computer language must be attached and the FORTRAN code compiled before initiating the simulation. Local ADP personnel should provide appropriate job control cards.

At Wright-Patterson on the ASD Cyber computer, with the data set indicated in Volume II, the simulation required approximately 340,000 core memory and 400 CPU seconds for execution.

ASSISTANCE

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